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J. M. WAKEMAN, - - - - - - - - President and General Manager.

CHICAGO OFFICE, - - - - - - - - - - - - 936 Monadnock Block.
PHILADELPHIA OFFICE, - - - - - - - - - - 929 Chestnut Street.

EUROPEAN OFFICE, - - - - - - - - - - - A. C. Shaw, Manager.
Hastings House, Norfolk St., Strand, London, England.
PARIS, - - - - - - - - - - Electricity Building, Paris Exposition.

T. C. MARTIN AND W. D. WEAVER, - - - - - - - - - Editors.
T. R. TALTAVALL, - - - - - - - - - - - - Associate Editor.
CARL HERING, - - - - - - - - - - - - - Special Contributor.

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MR. HUDSON.

That the late president of the American Bell Telephone Company should have been one of the best Greek scholars in this country is a sufficient reply to the criticism often heard that American men of affairs are mere money-making machines. He was also a kind and courteous gentleman whom to know was to esteem. His business ability was shown in many ways; and in his ten years of management the company grew from a system of 739 exchanges and 411,861 instruments to one of 1239 exchanges, 1,847,000 instruments and over a million miles of wire in service. His hard work of the past year has evidently been fatally excessive, and his successor will confront many serious and difficult problems.

THE ELECTRIC RAILWAY.

The approaching convention of the American Street Railway Association sums up again roughly the work of another year in that field of traction. It cannot be said that any great specific advance has been made, but there is distinct progress visible all along the line. Underground electric roads for urban traction have occupied more attention than anything else, and next to that in importance has been the changing from cable to conduit trolley. In methods of generation, the three-phase system for use in a large territory is the accepted plan. It is perhaps to such work as that between Kansas City and Leavenworth rather than that in Kansas City itself, that we must look for the great future. The field in the cities will always be large, but the big steam systems show signs of a coming change also, and there lies work beyond calculation.

The Yearbook of the Department of Agriculture for 1899 contains a very interesting chapter upon the development of transportation in the United States, by Angus Sinclair, the editor of *Locomotive Engineering*, a man thoroughly competent to write upon such a subject. The Department has printed a half-million copies of this chapter in a brochure for distribution. After setting forth the facts that the phenomenal growth of the United States is to be attributed chiefly to the development of the means of transportation during the past fifty years, and that the hope of America maintaining her advanced position among the nations of the earth is dependent upon the still further development of transportation facilities, Mr. Sinclair proceeds to describe graphically the mechanical difficulties that were encountered by the railroad engineers and constructors in the extension of the railway system of this country. He tells how isolated and opposing roads were brought into one system, and notes that the consolidators lost an opportunity pregnant with serious results. Finding a variety of gauges, they took the narrowest, 4 ft. 8½ ins., now standard, but "That gauge is too narrow for admitting a properly designed boiler upon a large locomotive. Many locomotives are already at work that have reached the limit of their capacity, because the limited gauge prevents the boiler from being made larger." Mr. Sinclair amplifies this theme a little and then remarks significantly: "It is believed in some quarters that the bottom cost has nearly been reached unless some revolutionary change is made in the track and motive power."

Mr. Sinclair's prophetic soul and keen insight might have carried him a little farther, for we see only one conclusion to the whole matter, viz., the steam roads must adopt electricity. There is no question about the truth of his statements, and they all point to the fact that much of the steam-operated railroad system will soon have to pass into

history. It is impossible to conceive the railroads of this country being entirely rebuilt to accommodate the increased size of locomotives. The simpler and more practical, and only, way out of the difficulty now presenting itself to the railroad companies will be the substitution of the electric motor for that triumph of invention and ingenuity, the steam engine, which is shown to have reached its limit of usefulness under existing conditions, a process which has already commenced upon some steam railroads both in this country and in Europe.

HANDLING EXPORT TRADE.

There can be no question that developing export trade depends upon something more than mere excellence of the article. The manner of presentation counts for much. An electrical concern in this city pushing its product abroad was recently advised by one of our consuls in Germany that English circulars were of little or no use there. This applies probably to his own section, for the general command of the English language by Germans is a matter of notoriety, especially in the engineering field. But the same consul advises the free use of the usual cuts in circulars, calling each of the devices by its equivalent name in German, and using good press work. This practice, supplementary to vigorous advertising for foreign trade, has been adopted with success by many machinery concerns, and by typewriter, cash register, bicycle and other companies. A good cut, indeed, does much to draw attention to advertising or to a circular, and if made with intelligence is largely self-explanatory.

It is, in short, in regard to illustration, quite as much as in respect to language, that the seeker for foreign trade must be careful. A case in point has recently been furnished by a maker of agricultural machinery who sent abroad a large quantity of pictures in which his mowing machine was shown with a team of tigers and with an unadorned Goddess of Liberty as driver. The foreign agent wrote back that the picture was more harrowing than otherwise. "The women of our country," he said, "when by circumstances to do agricultural work compelled, do not dress as your picture shows is the custom in your wonderful country, and would not deem such garments with modesty to consist. Also we do not tigers for draught purposes cultivate, they not being to the country native, nor in our experience for such work well suited." The agent even asseverated solemnly that he had to assure possible customers that the picture was an allegory.

It is possible that in the introduction of American electrical apparatus abroad similar mistakes are made, and have to be avoided. Names, colors, styles of package, are all elements of success or failure. We should esteem it a favor if any of our numerous foreign readers would advise us of such instances coming within their observation. None can give such practical advice upon these points as persons actually on the ground.

AUTOMOBILE FACTS

Many of our readers have watched with great interest the rapid developments taking place in the electric automobile field, and those who have perused our columns carefully have been able to follow the rapid changes pretty closely. But, even with the exceptional facilities naturally at our command, we have been unable to give to our readers all the information which they have wished. What they have asked for is *facts*—accurate facts regarding electric automobiles—and these we have been unable to supply with any degree of certainty. Hence we determined early this year to investigate the subject for ourselves, and try, if possible, to get some authentic information. With this idea in view, we secured the services of Mr. R. A. Fliess as Special Commissioner to obtain for us the desired data, as he had already given much time and attention to an investigation on similar lines to the one which we had in mind, the results of which were presented at a general meeting of the American Institute of Electrical Engineers a year ago last June. For the past six or seven months Mr. Fliess has therefore been engaged in collecting, classifying and arranging the data which was desired from actual work done by automobiles, and we are happy to be able to-day to present to our readers the first part of his report. It is a long and elaborate report, entitled "The Electric Automobile from a Commercial Point of View," contains a vast amount of valuable information, and shows on the face of it much hard work and painstaking care. That such data as is contained in it is what we have been in search of, a perusal of it will show.

We believe that this report, which begins in this week's issue, and will be continued in the several immediately subsequent numbers of this paper, is the first one that has ever been published in which an attempt has been made to determine with any degree of accuracy the exact commercial status of the electric automobile at the present period. That it comes at a most opportune moment will be admitted, for the public is having its attention strongly attracted to the subject of horseless vehicles by the numerous shows, fairs, exhibitions, races, etc., in which the automobile takes a prominent part. We believe that the report will supply a much felt want, as it gives accurate experimental data, obtained by a prefectly impartial investigator, who is well equipped to secure reliable and trustworthy results in this line, on the numerous points connected with the operation, maintenance, etc., of electric vehicles, which up to this time has not been available.

That the results and conclusions expressed in the article cannot, of course, be looked upon as final, Mr. Fliess is very careful to point out. "In fact," he says, "they must be looked upon as merely indicating the present state of development that has been reached in this branch of the horseless vehicle industry." When we recall the years of vicissitude, trials and hardships through which the telegraph, telephone, electric lighting, trolley and electric storage battery industries passed before they became the firmly established and highly successful industries that they are to-day, it would certainly seem as though those to whose efforts the present degree of progress in the development of the horseless vehicle is due are to be congratulated upon having in so few years brought the electric vehicle industry to its present promising state.

The first instalment of the report, which will be found elsewhere in this issue, contains much that is of value that cannot possibly be even indicated in our editorial columns. In the first section of the report much experimental data is given relating to the distance which electric vehicles may be expected to travel in the Borough of Manhattan on one charge of battery under the various weather conditions likely to be met with in the course of a year; also the amount of energy required to propel an electric vehicle in the borough is considered, and much experimental data is recorded. Many mooted points are briefly considered, viz., the advantages of friction-reducing devices; the advantages of light vehicles; the effect of pneumatic and solid tires on the rate of power consumption; the effect of snow on power consumption; the influence of different operators on the rate of power consumption; the efficiencies of batteries used in horseless vehicles, and the effect of improper treatment of the battery on the mileage of vehicles. The tables will bear and are commended for close study, as they contain much information which cannot be assimilated in any other way, and which it has taken much time and labor to collect.

In the second section a very complete and thorough report will be made on the amount of work that is at present required of horses engaged in the service of the light delivery departments of the large stores in New York; and some very valuable tables will be presented which, it is believed, are the first of their kind that have ever been published. In this section experimental data on the weight that is carried by wagons engaged in light delivery service in the borough is given, and the cost to the stores for their delivery service is considered. In section three an attempt has been made to determine the relative cost to a store engaged in light delivery service in the Borough of Manhattan, for electric and horse delivery wagons—and in this section for the first time, it is believed—the full determination of the present depreciation and repair charges for electric vehicles has been attempted. That the depreciation and repair question is a much discussed one, all know, but so far as we are aware, this is the first time that an attempt has been made to determine closely the exact relation of these charges to the total charge for maintenance, operation, etc., in any report which is available to the general public.

The courtesy shown by the Electrical Engineering Department of Columbia University in allowing the use of its laboratories and standard instruments for the purpose of calibrating the instruments used throughout the investigation has been much appreciated, as the knowledge that the instruments were kept accurately calibrated adds much weight to the value of the results presented. We desire also to thank the manufacturers and proprietors of large stores and livery stables who have aided Mr. Fliess. It is to be hoped that more such investigations will be made, as the information derived from them is both beneficial to the manufacturer and to the purchasing public, and must tend to place the horseless vehicle industry on a solid foundation.

Imperial Physico Technical Institution in Charlottenburg.

An interesting paper on this subject was read by Prof. Carhart last week before the American Institute of Electrical Engineers, calling attention to the excellent work done at that institution and its importance to Germany. The day is at hand when the relative superiority of nations will depend not merely on their wealth, but largely on their technical capabilities in all branches of engineering, and in the industries that are allied therewith. It is admitted that the German excellence in chemical industries has been brought about mainly by reason of the technical knowledge and skill fostered in special institutions for that purpose. There is a distinct need in the United States for a national laboratory which should furnish standardizing certificates on demand for all physical and chemical apparatus, and at which all machinery of precision could be examined and tested at a suitable rate of charges. This work could, if properly carried on, be made self-supporting. In conjunction with such an establishment, provision could be made especially for physical research and measurements along lines that would contribute to the efficiency of the establishment. This part of the work would not be directly self-supporting, but could be made of great value and national importance. At a moderate cost it would foster the development of the applied sciences and the arts depending on them, and would give a prestige to American apparatus which is at present lacking. It is to be hoped that such a Bureau may be established in Washington, primarily for the purpose of issuing duly authorized certificates upon the tests and measurements of all kinds of physical and chemical apparatus, and secondarily for improving the standards by which such apparatus is measured and tested. A bill for this general purpose received this year the unanimous support of the Congressional Committee on Coinage, Weights and Measures, but no favorable action has yet been taken upon it in Congress.

With the exception of a university for the promotion of learning, or of a hospital for the care of the sick, there is probably no institution of greater public importance or which would better deserve recognition and endowment than an institution similar to the German Imperial Reichsanstalt. Already various bureaus of the Government service have had thrust upon them the necessity of elaborate investigations in the course of their regular routine. Several of them have already established very excellent laboratories on such scale as their available funds have permitted, and have done much creditable work. As every scientific man knows, there has been in the course of this much reduplication of apparatus, involving great and unnecessary expense. A far more efficient and economical procedure would be the formation of a national institution to bring together all the research equipment of the various departments, with a liberal appropriation for maintenance and increase of plant, and let the details from the various departments do their work with the full advantage of the resources of the great national laboratory. The whole work could be under the supervision of the scientific head of the institution, while the various departments would assign the force necessary to carrying out their particular line of work. The standards department can easily rest on its own merits as part of the Government's contribution to the industrial progress of the nation. It needs no commercial defense.

But both the proposed branches of the service need defense against the spoils system. At the present time this is, fortunately, far easier than it would have been ten or fifteen years ago, but even now it will require persistent strength of purpose. Particularly, both appointment by the executive and the routine of Civil Service examinations are probably the worst possible methods of getting a suitable head and working staff for such an institution. Everything depends upon the proper organization of a governing body, permanently independent both of politics and Civil Service. Almost equally important is the safeguarding of the institution from commercial subserviency. The rule of the Reichanstalt that work done therein shall not be made the subject of patents is a step in the right direction, but it does not go nearly far enough. One excellent step toward freedom would be the ruthless publication, officially, of the results of all tests, devoid of all criticism for good or ill. By this we should avoid the spectacle of seeing the results of an elaborate investigation hidden behind the designation of apparatus as A, B and C. If all tests were officially made public, the results would become a source of most valuable practical information.

Besides this, steps should be taken for the legal protection of the institution. That is, the findings of the institution in matters of fact should not be open to review in the courts and should be considered final for legal purposes, at least within such restrictions as would make it almost impossible to go behind them. For instance, if the integrity of a standard became the point at issue in an action, the Court should have the right to refer the matter to the national institution, and its report should be final and not subject to revision or cross-examination. This would confer a heavy responsibility, but it would serve the ends of justice far better than the *ex parte* testimony at present introduced. By this same sign the scope of the work of the institution should be cautiously limited so as to keep it as far as possible from being flooded with commercial testing and confined to its legitimate object of scientific research and the verification of standards. A steady and firm hand at the helm would be needed to steer it on an even course, but the channel is clear, even if tortuous, and the passage can be safely made even between the Scylla of politics and the Charybdis of commercialism. But there would be need of genius in the pilot.

Sudden Death of President Hudson of the American Bell Telephone Company.

THE LATE JOHN E. HUDSON.

We regret to record the sudden death on Monday, Oct. 1, of Mr. John E. Hudson, president of the American Bell Telephone Company, of Boston. It appears that he had just left his carriage at the Beverly Farms railway station on the Boston & Maine Railroad, and was to take the 9:11 a. m. train for Boston. Mrs. Hudson was with him, and husband and wife were sitting in the waiting room. Suddenly Mr. Hudson threw up his hands and slipped from his seat to the floor. Several persons sprang toward the prostrate man, and he was raised up quickly, but it was plainly seen that he was dead. When a physician reached the station and had examined the body, he said that death was due to heart failure. Mrs. Hudson was completely overcome by the shock, and she was taken to the summer home of the family in a carriage. Soon afterward the body of Mr. Hudson was taken to the same place. When the news reached Boston there was naturally much excitement in the Bell offices, and the news spread quickly all over the country by means of the long distance system that Mr. Hudson had himself done so much to create. The effect on Bell telephone stock on the Boston exchange was to depress it a few points, but it rallied firmly during the day.

John Elbridge Hudson was born at Lynn, Mass., Aug. 3, 1839. He was a lineal descendant of the Thomas Hudson who came over from England in 1630. His maternal great-grandfather was the Rev. Samuel Hilliard, a pioneer in Universalism and a soldier of the Revolution, who served at Bunker Hill and Bennington. He entered Harvard College and was graduated with the highest honors, in the class of 1862, and from the Harvard Law School, in 1865. For some time he acted as Greek tutor in the university.

In 1880 he became general counsel of the American Bell Telephone Company, and devoted himself exclusively to its interests. In 1885 he was appointed general manager of the company, and in 1887 became vice-president. The same year he was made president of the American Telephone & Telegraph Company, and in 1889 was elected president of the American Bell Company, holding that position ever since. Under his administration the operations of the campany have been increased immensely, especially in the development and perfection of the long-distance service.

Mr. Hudson possessed great cultivation and was fond of literature and of art. The beautiful Bell Telephone Building, at the World's Fair, was conceived by him, and represented him quite as much as it represented telephony. He contributed somewhat to law reviews, and in 1879 edited, jointly with G. F. Williams, the tenth volume of the United States Digest. He was a member of the American Academy of Arts and Sciences, the American Antiquarian Society, British Association for the Advancement of Science, New England Historic and Genealogical Society, Colonial Society of Massachusetts, Bostonian Society, American Institute of Electrical Engineers, Selden Society, the Bar Association of the City of Boston, the Virginia Historical Society, and also the Boston Art, the St. Botolph and University Clubs.

Among those named as Mr. Hudson's successor are Mr. E. J. Hall, Jr., Mr. C. Jay French, Mr. C. F. Cutler and Mr. T. Jefferson Coolidge, Jr.

Renovation at Galveston, Tex.

Mr. John R. Cox, superintendent of the Brush Electric Light & Power Company, of Galveston, sends us some interesting data as to the damage done to electrical plants there by the recent great storm, as noted already in these pages. Speaking of the plant of the City Railroad Company, which operated forty cars and an alternating current lighting system, he says that it was completely wrecked by the smoke stack, which fell across the power house, wrecking every generator and engine. An entirely new station equipment is necessary. All the cars were under salt water for several hours. The city municipal lighting plant suffered by the roof and walls caving in on the engines and generators. By Sept. 23 nearly all the debris had been removed and the engines appeared to be unharmed, but the dynamos had been soaked by immersion and by heavy rain.

The Brush Company's plant is built in two sections, one of which is 12 ft. higher than the other. Each floor contains a duplicate set of machinery. The lower floor of the station is about 12 ft. above the street level, and on that floor the ocean rolled to a depth of 50 ins., submerging all the generators and the lower part of the switchboard. Mr. Cox was in Iowa when he heard of the terrible disaster that had visited the city. He made a bee line for home, and, arriving on the 14th, concluded that a little light would help things and tend to restore confidence. A hurried examination of the Brush plant showed that the upper floor machinery was unhurt, although the roof was off. Boilers and engines were also in fair condition, although the pole lines were in an extraordinary mess and tangle. Only twelve men were available, but they were put to work at once. No attempt was made to tighten the lines, the wires being simply hung on the cross-arms, and the slack being left to take care of itself tem porarily. In the meantime, all the inside wire men were busy fitting up weather-proof sockets with 32-cp lamps and extending the socket leads long enough to span the main leads. As fast as a section of the line was cleared one of these lamps was tapped onto the main at each pole. Early in the day the supply of waterproof sockets ran out. Westinghouse lamps were then used, by soldering leads direct to the bases, running a little sealing wax around the tip over the porcelain as an extra precaution. All of these lamps were tapped solid without fuses. By 5 o'clock in the afternoon current was turned on, furnishing light for 48 blocks, uring 192 lamps. Mr. Cox says:

"The surprise and pleasure this result afforded was well worth the effort, and too much praise cannot be bestowed upon those who did the hard work necessary to accomplish it. A dusk-to-daylight service was established, the daylight being used to re-establish the whole system. So far we have had no trouble from the temporary wiring. All of the submerged machines are being baked, but I fear the salt has been absorbed to an extent greater than will be safe for operation. The field coils dry out and show a high resistance, but one of the armatures shows practically none after six days' drying."

As to the street railway system, Mr. Cox says that the service will be restored by the aid of the Brush Company's plant, which comprises a 75-kw 500-volt generator. Resumption was expected by Sept. 26. Mr. Cox is noting closely the effect of salt water on all the street railway and lighting apparatus.

Rapid Transit Tunnel to Brooklyn.

The New York Rapid Transit Board on Sept. 27 adopted the route and plans of construction for a rapid transit tunnel from Manhattan to Brooklyn. The plan is to extend the Broadway tunnel down Whitehall Street to the East River, thence under the river to the Brooklyn shore at the foot of Joralemon Street, thence to the city hall, where there will be a station; thence under Fulton Street to Flatbush and Atlantic Avenues, which will be the terminus for the present. The river part of the tunnel, with its approaches, will consist of cast iron tubes of a diameter of 15 ft., forming practically a separate tunnel for each track. The plans also provide for an additional loop on the Manhattan side, beginning under Broadway, somewhere near Exchange Place, and running under Bowling Green, State Street, Battery Park and Whitehall Street back to Broadway. Different grades will be provided for trains turning into this loop and the through Brooklyn trains. It will be a long time, however, before the contracts for construction can be let. The proposition must, first of all, go before the Municipal Assembly. If it is approved by that body the consent of the property owners must be obtained, which may require a whole year.

Berlin Storage Battery Cars.

The technical commission appointed by the German Ministry of Public Work to investigate the suitability of storage battery cars has reported that such cars are not yet suitable for the heavy street traffic of Berlin. As a result, it has been decided by Imperial authority to abandon gradually the use of accumulator cars on the Berlin tramways, and to substitute the overhead trolley system, except in special busy sections, where the underground conduit method will be introduced.

The Street Railway System of Kansas City.

THE visit of the American Street Railway Association to Kansas City for its annual convention directs attention to the street railway system of that rapidly advancing centre of Western trade. The population of the two sections of the city in Kansas and Missouri, according to the present census, is 215,000, and since the recovery of the region from the extreme depression of 1893, the increase in wealth, in trade and in fine business and residential buildings has been most noteworthy. As a necessary consequence there has been also a rapid development of urban transit facilities, so that Kansas City is fully abreast of other places, and, in fact, in advance of not a few, in the magnitude of her street railway system. From the first her peculiar conformation, of rolling land, high bluffs and stiff grades, made the city a favorite ground for experimenting with mechanical traction, and until quite lately it was regarded as one of the strongholds of the cable. Still, it is now virtually electric throughout; and as was shown by the graphic story told by Mr. J. C. Henry in these pages last week, some of the most important pioneer work in the application of electricity to street cars was done twenty years ago in the then crude, bustling frontier town. It has always been a specialty of "bleeding Kansas" to take a foremost part in the making of American history; and her pre-eminence in this respect was sustained in the great revolution of traction methods, little as most of her own citizens suspected it or cared.

It is quite unnecessary in these pages to go into the evolution of the existing street railway service of Kansas City. There is practically one large corporation, the Metropolitan Street Railway Company, doing the whole of the work as the result of growth, accretion and consolidation, supplemented by a small road in individual hands and a long distance suburban road to Leavenworth. For the purposes of this brief review the Metropolitan cable plants may be neglected, for even now they "have had their day and cease to be." The twenty lines in the city operated by the Metropolitan Company have a total length of 160 miles of track. Of this 120 miles are now operated electrically, and the 40 miles of cable is already actively in the transition state to electricity. In addition to this, some 15 miles of new road are in process of construction. The Holmes family has long been prominent in ownership of the Metropolitan system, as thus outlined, and Mr. W. H. Holmes is president, Mr. C. F. Holmes general manager, and Mr. D. B. Holmes general counsel. The largest owner is, however, Mr. P. D. Armour, of Chicago. Mr. W. H. Latterbee is general superintendent, Mr. D. W. Dozier chief mechanical engineer, Mr. C. Grover electrical engineer, and Mr. J. W. G. Becker master mechanic. The company has a capital stock of $8,500,000, of which $5,586,000 is issued. There are $5,100,000 of 5 per cent bonds, and $7,500,000 of underlying guaranteed companies' bonds. The gross earnings last year were $2,353,267, and the rate of dividend has been 1¼ per cent quarterly. The company owns about 800 cars, the electrics being equipped with General Electric motors, and many of them with motor driven air brakes. With the introduction of mechanical power has come an extensive transfer system, about half the passenger receipts being represented by transfers. There are 85 transfer points and the company now issues about 70,000 transfers daily. The cars operate not merely on street surface, but at some points encounter either tunnel or elevated track. The cable cars run at 9 miles an hour, and the electrics average 12.

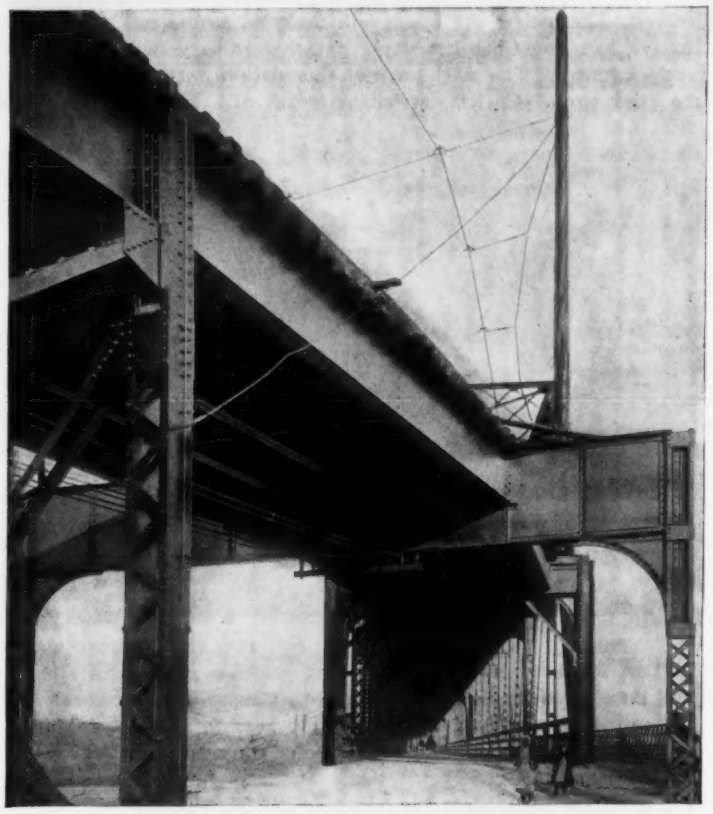


FIG. 2.—ELEVATED TRACK, KANSAS CITY.

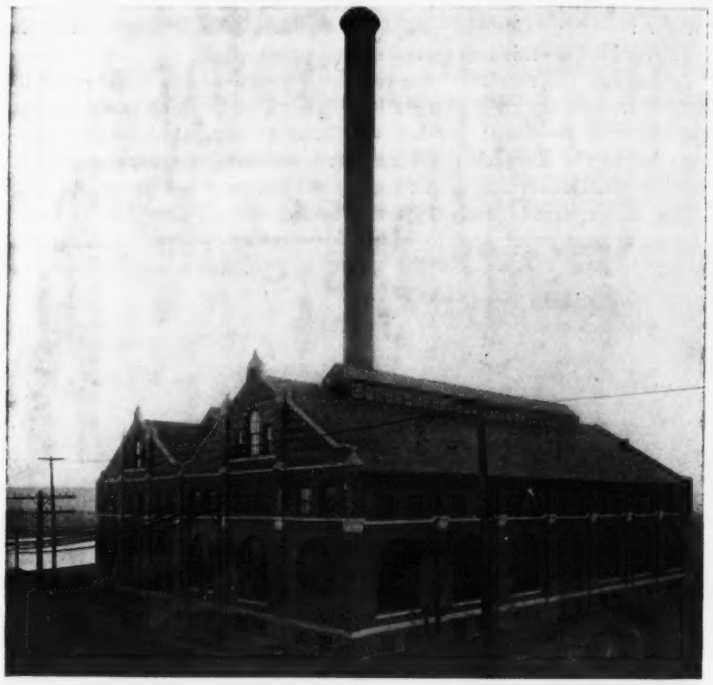


FIG. 1—KAW RIVER POWER HOUSE. EXTERIOR.

FIG. 3.—KAW RIVER POWER HOUSE. INTERIOR.

There are a number of power plants feeding the network, and to these attention is called in the accompanying illustrations, leaving aside the mere cable plants. The Metropolitan system depends for current upon its Blue River and Kaw River power houses. The latter contains an engine capacity of nearly 7000 horse-power, and generated in 1899 5,608,000 kilowatt-hours at a cost of less than ½ cent per kilowatt-hour. The building is a brick structure with steel framework. The engine room is 144 ft. long and 63 ft. wide; the boiler

room is 144 ft. long by 51 ft. wide, and the height of both is 33 ft. 7 ins. from the top of the foundations to the under side of the bottom chords of the roof trusses. The boiler room contains Babcock & Wilcox and Cahall boilers of the horizontal type, in batteries of 500 horse-power each, which will shortly be supplemented by four more 500-hp boilers. The boilers are fitted with B. & W. and Green chain-grate stokers, handling Cherokee slack coal, the ordinary fuel in that part of the country. The steel stack of this station is 175 ft. high above the brick work. Coal is carried by means of a Hunt conveyor and

FIG. 4.—BLUE RIVER POWER HOUSE. EXTERIOR.

cars into bins over the boiler room, with a capacity of 600 tons. The engine room contains four Allis-Corliss horizontal engines, tandem, or cross-compound. Two of these are direct-coupled to Walker and two to General Electric generators. The last of these four units was put in during the present year, and is one of the largest railway machines in the country. The engine is rated at 2500 horse-power, and the generator at 1600 kilowatts, with a 40 per cent overload capacity for three hours' time. This engine has independent Allis air and circulating pumps, the two machines being independent of each other. It exhausts into a Wheeler condenser with an effective surface of 5000 sq. ft. The shaft of this engine is of hollow-forged fluid-compressed steel, and the flywheel is 24 ft. in diameter, with a weight of 160,000 pounds.

The switchboard of this station is double-decked, the feeder panels being on the gallery. A large number of recording wattmeters are been in use, the object being to give records of the power used on the

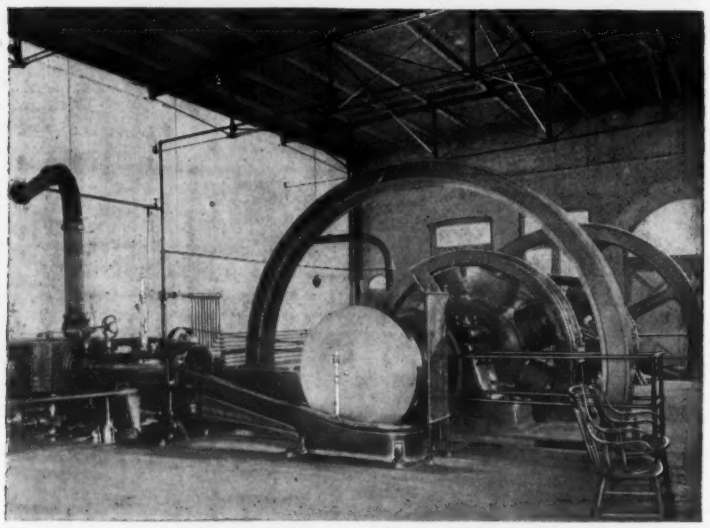


FIG. 5.—BLUE RIVER POWER HOUSE. INTERIOR.

various lines, which are, as a rule, separately run on individual feeders, the overhead copper not being cross-connected out on the lines. As this station supplies all of the electric lines with the exception of the Independence road, and as it is some distance from several of the lines on the Missouri side of the Missouri River, a large amount of copper runs out from it, there being 30 feeders with a cross-section varying from 300,000 to 1,000,000 circ. mils.

The Blue River power house contains a 250-kw and a 400-kw generator, both of General Electric make. They are driven by simple Corliss engines, condensing. The boilers are horizontal tubular, with manual stoking. From this plant current is delivered to the Independence and Fairmount Park lines.

One of the Metropolitan cable lines is also operated electrically by motor, viz., the Summit Street, which includes over 4 miles of track. The motor drives the cable machinery by belt, and is said to do its

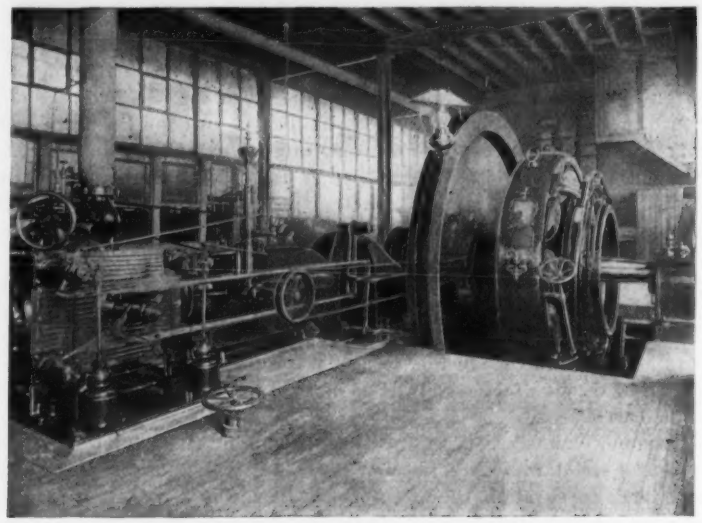


FIG. 6.—INTERIOR OF HEIM POWER HOUSE.

work quite satisfactorily with considerable economy over the old style of direct engine driving. The motor is a 300-kw Thomson-Houston four-pole generator. From 10 to 16 trains are on this cable at one time, the line having one 10 per cent grade. The motor input varies from 200 amperes to 600 amperes, running up to 800 amperes on heavy traffic. The motor is compound-wound, half of the original series coils being used for this purpose, the two coils on two opposite poles being cut in, the two other coils being cut out. It is started with a water rheostat. Complete duplicate motors, cable drivers and cables are provided on this line as emergency precautions.

Although the results of the smaller Blue River plant are good, the superior economy of the larger Kaw River plant, which is about twice as economical—$.0041 per kilowatt-hour as compared with $.0079—has led to the formation of plans for a modern polyphase station, on which Mr. Grover has been figuring. It is likely to be erected on the Blue River, immediately adjacent to the site of the present power house at that point, and to contain several 25-cycle 6600-volt generators of 1500-kw or 2000-kw sizes. The consulting engineers are Messrs. Pierce, Richardson & Neiler, of Chicago. Two rotary con-

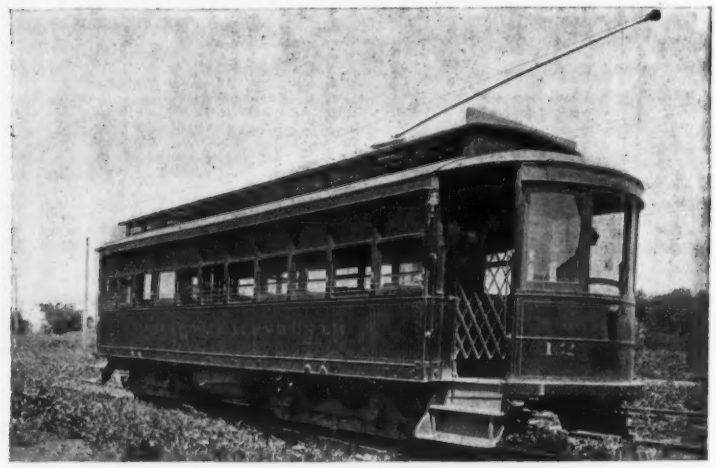


FIG. 7.—LEAVENWORTH CAR.

verter sub-stations for the traction system will be put in at present cable stations, relieving the Kaw River plant of a large part of the Missouri load from the Kaw River station, cutting down greatly the amount of copper required for feeders, and leaving the Kaw River station to supply current only on its own side of the city. The company is now dealing with the questions involved in this new departure.

The East Side Electric Railway, built by the brewing family of Heim, as a means primarily of reaching their park, is a double track road three miles in length, extending eastwardly on the low lands along the Missouri River. Extensions of 4 miles more are planned, and the system may be expanded even beyond that. There are 14 cars, 6 of which are equipped with Westinghouse motors. The power house of this line contains a Siemens & Halske 200-kw generator, direct coupled to a St. Louis-Corliss engine, running at 100 r. p. m. In addition, there are two D 62's and two 110-volt lighting machines

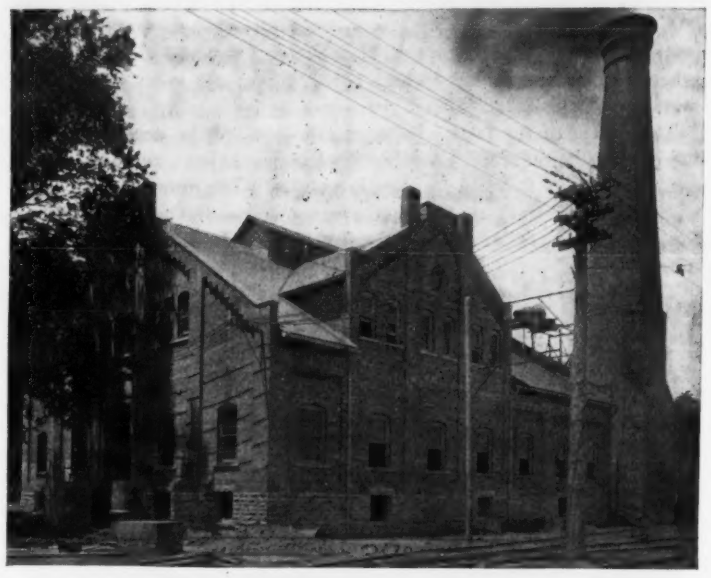


FIG. 8.—LEAVENWORTH POWER HOUSE. EXTERIOR.

for illuminating the pleasure park. The 500-volt switchboard of the power house consists of a remodeled Thomson-Houston board, with back connections and instrument cases. In the park itself a large number of Adams-Bagnall enclosed arcs are in use.

The remaining system to mention is that of the Kansas City & Leavenworth Electric Railway Company, which has a line running from Kansas City to the prosperous city of Leavenworth, some 26 miles to the north. The road is single track, on its own right of way, and corresponding in most other respects to a regular steam railroad, so that a high rate of speed can be maintained uninterruptedly. The track is 61-pound T-rail, on white oak ties, rock ballasted, with Atkinson protected bonds. No. 000 trolley wire, "figure eight" pattern,

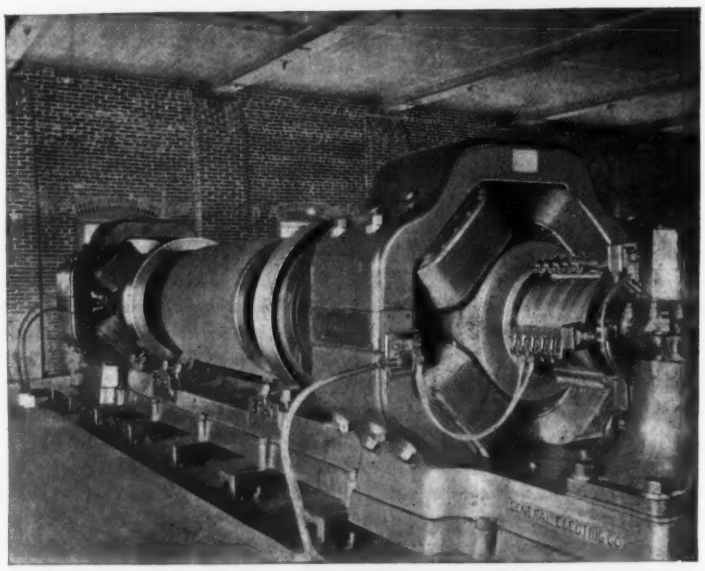


FIG. 9.—INTERIOR OF LEAVENWORTH POWER HOUSE.

is used. For feeders from the power house, which is at Wolcott, midway on the road, and about 12 miles from either terminus, bare aluminum conductors are used, with a cross section of 362,000 circ. mils. There are nine such feeders. The rolling stock comprises ten cars of the type shown herewith, each car being 41 ft. long, 9 ft. in over-all width, and weighing 22 tons, with four "Steel" 50-hp motors to each car, capable of speeding up to 45 miles an hour. The cars carry only one controller, and have air brakes. The fare is 50 cents, or 75 cents for the round trip, with a schedule time of 75 minutes for the single run, and 15 regular stops en route. Trains of three cars run every hour on week days, and of six to eight cars every half hour on Sunday. In addition to the passenger cars there is a 200-hp four-motor electric locomotive to haul coal, etc. The owners of the road are Cleveland men, and the general manager is Mr. H. W. Wolcott, of Wolcott, Kan. The power house at Wolcott is a handsome brick building with substantial chimney of great diameter, 140 ft. high, and tapering sharply to resist cyclones. The station contains four Stirling boilers and one Hamilton-Corliss single cylinder engine, belted to two 300-kw General Electric four-pole generators, in line with each other, and connected by clutch couplings to the central pulley. It is likely that for extensions polyphase apparatus will be installed.

Large Dynamos at the Paris Exposition.

An interesting paper was read before the British Association for the Advancement of Science by Prof. S. P. Thompson on "The construction of large dynamos as exemplified at the Paris Exposition." He referred to the continual changes which are taking place in the design of electrical apparatus, and of the way in which practices which seemed to be quite standardized are gradually discarded in different countries. The alternators exhibited he characterized "as getting more flywheel in style," that is, they are increasing in diameter and decreasing in length. There are exhibited three alternators of the type with a stationary armature inside a revolving magnet system, the field magnet system overhanging at one side of the flywheel. The advantage of this type is a mechanical one; with the poles fixed on the inside of the extended rim of the flywheel, the centrifugal force of the revolving mass of each pole tends to keep it in place against the rim; it also counteracts the magnetic pull which is inward. In the type of alternator field with the poles projecting outward from the flywheel, both the centrifugal force and the magnetic pull are in the same direction, and mechanical means are necessary for attaching the poles to the rim. The practice of laminating the field magnet cores has practically disappeared so far as Continental makers are concerned; they use instead a cast-steel core with a laminated pole tip.

He had looked into the question of the number of slots per pole per phase, used by European Continental makers. In the case of one large machine it is as low as one slot, but the greater number have at least two slots. In the largest alternator of the General Electric Company, of Berlin, five slots are used; one machine has two and one-half slots per pole. In the winding of direct current armatures, and also in certain alternators, the cylindrical winding is very largely used; there are at least two conductors in each slot, one above the other, the lower conductors being bent round the armature in one direction and the upper in another, but being always kept at the same distance from the axis, so as to form ultimately a cylinder. On a machine of Ganz & Company he had found a most unsymmetrical system of winding; the reason is that it enables certain sections of the armature core, equal to four poles, to be wound in the shop, while only single connections have to be made to each circuit when erecting the various sections in the station. The Russian branch of Siemens & Halske exhibited a direct current dynamo in which the tendency to spark is kept down by the following means: The inner surfaces of the poles do not form a cylindrical surface concentric with that of the armature; instead of this, the width of air-gap is increased, being smallest at the edge of the pole which the armature conductors approach, and largest at the edge from which the conductors recede; in the case in point the increase is from 7 mm to 9 mm. He has tested some of the machines by Steinmetz's rule, in which d is the diameter of the revolving part and l equals the length of core; Steinmetz found then that the expression $d\ l/k\ w$ gave a numeric varying from 6 in bad designs down to 3 in good designs; with an increase in size, however, the numeric decreases so that for a 1000-hp machine he has found the figure as low as 1½.

Half Rates for Soldiers and Sailors in China.

The Western Union Telegraph Company announces that the Government administrations and cable companies, whose lines are used for communication with the Far East, have agreed to send telegrams between soldiers and sailors of the allied forces in China and their relatives at home for one-half the rate charged for commercial messages. The regular rate between New York and China is $1.60 a word.

The Electric Automobile from a Commercial Point of View—I.

By Robert A. Fliess, E. E.

INTRODUCTORY.

THE great interest now being evinced by both the general and technical public in the rapid developments taking place in the field of mechanical transportation on common roads led the writer, at the request of the Electrical World and Engineer, to make an extended investigation as to the present status of the electric automobile from a commercial point of view. The data collected, the results obtained, and the conclusions reached during the time spent in this inquiry form the basis of this paper.

Owing to the rapid changes and great improvements constantly being made in this new department of industry, the results obtained in an inquiry of this nature can not of necessity be considered final. In fact, they must be looked upon as merely indicating the present state of development that has been reached in this branch of the horseless vehicle industry.

That the successful solution, from a commercial point of view, of the problems connected with mechanically propelled vehicles on common roads is not far off seems almost certain. But that there are many hard questions still left to be settled before the advent of "the horseless age," is recognized by all who have given close attention and thought to this subject.

We are living in an age of progress—of wonderful progress—and the present generation has become so accustomed to hearing of and seeing the results of great inventions that it has come to look upon all things as possible, and is very apt to underestimate and depreciate the difficulties which confront the inventors, engineers and manufacturers who are attempting to place the civilization of our globe upon a higher plane. That, in the case of the horseless vehicle problem, the difficulties to be surmounted are very great, does not seem to be generally recognized. That the workers in this field have been confronted from the beginning with what would seem to have been almost unsurmountable obstacles, is, nevertheless, a fact, and that they have so far surmounted all barriers as to bring the horseless vehicle on common roads to its present state of development is a cause for general congratulation and a ground for just pride in the growth of the art.

That the electric automobile has reached a point in its development where it has begun seriously to enter into the daily commercial life of such a city as New York is evidenced by the greatly increased number of such vehicles now operating upon its streets. It would seem, therefore, as though an inquiry as to its relative commercial value, compared with that of one of the horse systems with which it has entered into competition, would be of interest and benefit.

Owing to the nature of the problem which presents itself when an attempt is made to compare the two systems of locomotion from a commercial point of view, the most accurate and therefore the most valuable results can be obtained at present from a comparison of the electric automobiles used in light delivery service with horses and wagons engaged in the same class of service. For this reason light horse delivery service has been selected as a basis of comparison.

To facilitate the presentation of the data in hand, this report. which is the result of an extended investigation, has been divided into three sections. In the first and present part, some tests on electric automobiles in the Borough of Manhattan are recorded. In the second the nature and amount of work required of horses and wagons engaged in light horse delivery service in the borough is considered, and its cost. In the third the results obtained in sections one and two will be compared.

It may be well to remark here that all the data incorporated in this paper was obtained at first hands by the writer and is published here for the first time, and that all the results and conclusions reached are based entirely upon this independently collected data.

SOME TESTS ON ELECTRIC AUTOMOBILES.

In this section some tests made on electric automobiles are presented and the results obtained are considered. The tests were made in the Borough of Manhattan, New York City, and the conclusions reached are based on tests which covered over 250 miles on its streets with 10 vehicles of six different makes.

The object of the tests was to obtain data for the determination of the present commercial position of electric vehicles and the greatest care was taken to insure accurate results. The number of vehicles tested, and the fact that they represent some of the best makes in the United States, adds to the value of the data that has been obtained.

To the several manufacturers and merchants whose kindness in placing their vehicles at his disposal, has made the preparation of this report possible, and for other courtesies the writer desires to express his thanks, as well as individually to the many persons who kindly assisted him while he was actually engaged in carrying out his tests. He takes this opportunity to acknowledge his indebtedness more especially to the American Electric Vehicle Company, of 134 West Thirty-eighth Street; the Woods Motor Vehicle Company, of Forty-fourth Street and Vanderbilt Avenue, and to F. R. Wood & Son, of 219 West Nineteenth Street, this city, for special courtesies shown by them while he was testing their vehicles, and to Machado & Roller, of 203 Broadway, for the use of a Whitney voltmeter and ammeter, used in all the tests recorded. His thanks are also due the Electrical Engineering Department of Columbia University for kindly permitting the use of its electrical laboratories for testing purposes, for a Thomson recording watt-hour meter and for the use of its standard instruments for calibrating purposes, and to Mr. W. C. Jessup, a recent graduate in electrical engineering of Columbia University, who, in the preparation of his graduation thesis, assisted with the tests recorded in this section.

The reasons for making these tests and the methods employed in obtaining the results to be presented need a few words of explanation.

For comparative purposes, from a commercial point of view, it is desirable to know how far an electric vehicle may be expected to travel on one charge of its battery in regular routine service over the streets of the locality in which it is expected to operate. This is to determine whether an electric vehicle can successfully travel on one charge of its battery a distance equal to that required on one trip of vehicles drawn by horses engaged in the class of service with which a comparison is desired. Also the average amount of energy required by well-designed and properly-cared-for electric vehicles to propel them over the streets of the locality in which they are to operate under the various conditions of weather and pavement with which they are likely to meet throughout the year while fulfilling the functions for which they are intended, must be known.

The average speed which electric vehicles may be expected to maintain when in motion while engaged in actual service under the ordinary traffic conditions with which they will probably be confronted must also be known before a just comparison can be made, as well as their ability to overcome successfully all the obstacles which the horse-drawn vehicle, of the class with which the comparison is to be made, is obliged to "negotiate."

To determine these points, for the Borough of Manhattan, a number of electric vehicles of different makes and of several varieties were tested over the streets of the borough under ordinary traffic conditions until enough tests had been made to eliminate any chance of error that might have arisen had only one vehicle of any particular make been employed.

The method followed in collecting the data sought was to measure the distance covered on each test on a cyclometer which was tested several times against a known standard and was found to be accurate, while the amount of energy used on each test was obtained by means of a Thomson recording watt-hour meter which was calibrated several times during the period over which this investigation extended against the standard instruments of the Electrical Engi-

neering Department of Columbia University. The instantaneous rate of power consumption was noted on a Whitney voltmeter and ammeter which were also calibrated several times against the standard instruments of the Electrical Engineering Department of Columbia University. The weight of the vehicle tested was obtained at the time of test on a pair of balanced Fairbanks coal scales—the same scales were used each time, to eliminate any chance of error which might have crept in from a change in scales. The speed at any moment during a trip was noted on a tachometer which was tested several times during the course of the investigation. The grades at the points where readings of the instantaneous rate of power consumption were taken were measured, so that in each case any variation in the rate of power consumption might be traced to its source. The elapsed time was noted at many points during each trip; also the voltage on open circuit, and the distance traveled to the point, as well as the reading of the watt-hour meter. Therefore, at the end of each test a complete analysis of it was possible.

On account of the care that was taken to keep all the instruments used accurately calibrated and as free as possible from injurious shocks and jars which might affect them, it is thought that the tests

FIG. I.—READY FOR A TEST. BEFORE THE START.

presented in the following tables may be taken as representative of what may be required of electric vehicles in general to-day under similar circumstances.

Owing to the fact that many comparisons are made between the several vehicles of different makes noted in this section, it is thought desirable not to designate any of the vehicles by means of their makers' names, but rather to give to each vehicle noted in this section a designating letter. The object of this paper was not to compare different makes of electric vehicles, but to present original data of a sufficiently representative kind to make its comparison with data collected from tests on one of the several horse systems, with which the electric vehicle is now competing, of value.

The eight photographs of electric automobiles which illustrate this section show some of the vehicles tested. The pictures in each case were taken while a test was in progress on the vehicle. In one or two of the photographs some of the instruments used on the tests can be seen.

A TEST FOR DISTANCE.

Table I gives in detail a complete analysis of a run of 31.5 miles made on one charge of battery by an electric delivery wagon designed for use in light delivery service. The conditions under which this test was made were perfectly normal. The streets over which the vehicle traveled were very crowded, and the route selected for the test included about as many hills as a vehicle may be expected to be called upon to go up and down in an average day's work under service conditions. The test is given in detail, to illustrate the method employed in all the tests made. The other tests presented are very much more condensed.

TABLE I.

[*Vehicle A.*]

Weight of vehicle	3,085 lbs.
Weight of passengers and instruments	305 lbs.
Weight of load carried	—
Total weight causing drawbar pull on test	3,390 lbs.
Battery equipment	44 cells
Weight of battery	1,120 lbs.
Per cent of battery weight to total weight of vehicle	36.3%
Per cent of battery weight to total weight causing drawbar pull	33. %

Weather clear; no wind. Streets in good condition.

Principal ground covered on test: Fifth Avenue, from Twentieth Street to 110th Street; Fifty-ninth Street, from Fifth Avenue to Eighth Avenue; 110th Street, from Fifth Avenue to Eighth Avenue; Eighth Avenue, from Fifty-ninth Street to 110th Street; Eighth Avenue, from Twenty-first Street to Forty-second Street; Twenty-first Street, from Fifth Avenue to Eighth Avenue.

Total distance covered during test	31.51 miles
Total time in motion during test	3 hr. 23 min. 35 sec.
Average speed while in motion	9.28 miles per hr.
Total watt-hours used on trip	4,892.8
Average watt-hours used per car-mile	155.27
Average watt-hours used per ton-mile	91.6
For a distance of	1.44 miles
Time in motion was	11 min.
Average speed while in motion	7.85 miles per hr.
Number of watt-hours used	216
Average watt-hours used per car-mile	150
Average watt-hours used per ton-mile	88.49
For a distance of	2.55 miles
Time in motion was	14 min.
Average speed while in motion	10.93 miles per hr.
Number of watt-hours used	328
Average watt-hours used per car-mile	128.62
Average watt-hours used per ton-mile	75.88
For a distance of	3.12 miles
Time in motion was	18 min. 50 sec.
Average speed while in motion	9.94 miles per hr.
Number of watt-hours used	568
Average watt-hours used per car-mile	182.05
Average watt-hours used per ton-mile	107.4
For a distance of	0.59 mile
Time in motion was	4 min.
Average speed while in motion	8.85 miles per hr.
Number of watt-hours used	62.4
Average watt-hours used per car-mile	105.76
Average watt-hours used per ton-mile	62.39
For a distance of	3.2 miles
Time in motion was	21 min.
Average speed while in motion	9.14 miles per hr.
Number of watt-hours used	476.8
Average watt-hours used per car-mile	149.
Average watt-hours used per ton-mile	87.9
For a distance of	3.04 miles
Time in motion was	17 min. 30 sec.
Average speed while in motion	10.42 miles per hr.
Number of watt-hours used	484.8
Average watt-hours used per car-mile	159.47
Average watt-hours used per ton-mile	94.08
For a distance of	2.55 miles
Time in motion was	14 min. 50 sec.
Average speed while in motion	10.31 miles per hr.
Number of watt-hours used	339.2
Average watt-hours used per car-mile	133.02
Average watt-hours used per ton-mile	78.41
For a distance of	3.12 miles
Time in motion was	19 min. 30 sec.
Average speed while in motion	9.6 miles per hr.
Number of watt-hours used	550.4
Average watt-hours used per car-mile	176.41
Average watt-hours used per ton-mile	104.07
For a distance of	0.61 miles
Time in motion was	5 min.
Average speed while in motion	7.32 miles per hr.
Number of watt-hours used	64
Average watt-hours used per car-mile	104.92
Average watt-hours used per ton-mile	61.9
For a distance of	2.54 miles
Time in motion was	15 min. 30 sec.
Average speed while in motion	9.83 miles per hr.
Number of watt-hours used	353.6
Average watt-hours used per car-mile	139.22
Average watt-hours used per ton-mile	82.13
For a distance of	3.12 miles
Time in motion was	21 min. 30 sec.
Average speed while in motion	8.7 miles per hr.
Number of watt-hours used	548.8
Average watt-hours used per car-mile	175.89
Average watt-hours used per ton-mile	103.77
For a distance of	0.61 mile
Time in motion was	4 min.
Average speed while in motion	9.15 miles per hr.
Number of watt-hours used	72
Average watt-hours used per car-mile	118.03
Average watt-hours used per ton-mile	69.63
For a distance of	1.44 miles
Time in motion was	10 min.
Average speed while in motion	8.64 miles per hr.
Number of watt-hours used	224
Average watt-hours used per car-mile	155.55
Average watt-hours used per ton-mile	91.77
For a distance of	1.53 miles
Time in motion was	13 min. 25 sec.
Average speed while in motion	6.84 miles per hr.
Number of watt-hours used	230.4
Average watt-hours used per car-mile	150.58
Average watt-hours used per ton-mile	88.83

For a distance of.....2.04 miles
Time in motion was.....13 min.
Average speed while in motion.....9.42 miles per hr.
Number of watt-hours used.....374.4
Average watt-hours used per car-mile.....183.53
Average watt-hours used per ton-mile.....108.27

Open circuit voltage at beginning of run.....95 volts
Open circuit voltage at end of run.....82.5 volts

Drop in 31.51 miles.....12.5 volts

Running voltage at beginning of run.....90 volts
Running voltage at end of run.....76 volts

Drop in 31.51 miles.....14 volts

Charging Battery After Run.

Charged for 3 hours at .....20 amperes
Charged for 2 hours at.....15 amperes
Ampere-hours put in during charge.....90
Battery boiling hard at end of charge.
Watt-hours put in battery during charge.....7124.52
Watt-hours taken out of battery during run.....4892.8
Open circuit voltage before run.....95 volts
Open circuit voltage after charging.....95 volts
Efficiency of battery.....68.67%

A consideration of Table I shows that vehicle A, with a load due to two persons and the instruments used, covered over 31.5 miles at an average speed of over 9.2 miles an hour, and that having traveled this distance its running voltage was still above 1.72 volts per cell, and its open circuit voltage still over 1.87 volts per cell, that the total average rate of power consumption was less than 92 watt-hours per ton mile, and that the maximum rate of power consumption noted was less than 108.5 watt-hours per ton mile.

As will be noticed, the total distance covered on this run was divided into 15 sections. On each section the time while in motion was observed, and from it and the distance recorded the average speed while in motion was calculated. In the notes taken while making the test, all momentary stops were noted and have been deducted from the time which elapsed while the vehicle was covering the distance given. Hence, the speed recorded in each section for the vehicle while in motion, it is thought, closely represents the best average speed which it would be possible to keep up on each section under ordinary traffic conditions. Thus, for instance, the first section includes a very crowded district for the greater part of its length. The second section, on the other hand, is never as crowded as the first, while the third section is usually a little more crowded than section two, but is seldom as crowded as section one. This condition is reflected by the average speeds recorded in the sections. It may also be interesting to note how the energy required on different sections varies. For example, in section two the vehicle was going down grade more than it was going up, while in section three it was going up hill more than it was going down. Thus the general contour of the ground over which the vehicle was traveling may be followed quite plainly.

A little over 25 miles of this test were covered while making four complete circles around the outside of Central Park. Table II shows in a concise form the results obtained during this part of the test. Table II is compiled from Table I, and affords a convenient means of comparing vehicle A with other vehicles traveling over the same ground.

TABLE II.

[*Vehicle A.*]

Once around Central Park—North on Fifth Avenue, south on Eighth Avenue.

For a distance of.....6.26 miles
Time in motion was.....36 min. 50 sec.
Average speed while in motion.....10.19 miles per hr.
Number of watt-hours used.....958.4
Average watt-hours used per car-mile.....153.09
Average watt-hours used per ton-mile.....90.31

For a distance of.....6.27 miles
Time in motion was.....41 min.
Average speed while in motion.....9.17 miles per hr.
Number of watt-hours used.....974.4
Average watt-hours used per car-mile.....155.4
Average watt-hours used per ton-mile.....91.68

For a distance of.....6.28 miles
Time in motion was.....39 min. 20 sec.
Average speed while in motion.....9.58 miles per hr.
Number of watt-hours used.....953.6
Average watt-hours used per car-mile.....151.84
Average watt-hours used per ton-mile.....89.58

Once around Central Park—North on Eighth Avenue, south on Fifth Avenue.

For a distance of.....6.24 miles
Time in motion was.....38 min. 30 sec.
Average speed while in motion.....9.78 miles per hr.
Number of watt-hours used.....961.6
Average watt-hours used per car-mile.....154.24
Average watt-hours used per ton-mile.....90.99

Three times around Central Park—North on Fifth Avenue, south on Eighth Avenue.

For a distance of.....18.81 miles
Time in motion was.....1 hr. 56 min. 10 sec.
Average speed while in motion.....9.72 miles per hr.
Number of watt-hours used.....2,886.4
Average watt-hours used per car-mile.....153.45
Average watt-hours used per ton-mile.....90.53

READINGS OF INSTANTANEOUS RATE OF POWER CONSUMPTION AT DIFFERENT POINTS EN ROUTE.

Location of Vehicle When Reading was Taken.	Voltmeter Reading.	Ammeter Reading.	Speed in Miles Per Hour.	Kind of Pavement Traveling Over.	Per Cent Grade at Point of Reading.
62nd St. & 5th Ave.....Going N	90	22	9.75	A	.....
65th " " " " ..... " "	90	21	10.3	"	.....
68th " " " " ..... " "	90	32	7	"	2.5
Passing Lenox Library..... " "	90	25	9	"	.....
" Synagogue door..... " "	90	21	10	"	.....
83rd St. & 5th Ave..... " "	90	24	9.5	"	.....
87th " " " " ..... " "	90	32	7	"	2.5
88th " " " " ..... " "	90	28	7.3	"	2.5
110th " bet. Lenox & 7th Aves..... " W	90	27	7.5	M	slight up
108th " & 8th Ave..... " S	90	32	6.5	A	2.6
106th " " " " ..... " "	90	30	7.5	"	2.4
101st " " " " ..... " "	90	19	11.8	"	slight down
96th " " " " ..... " "	90	27	8	"	2.5
94th " " " " ..... " "	90	26	8.5	"	2.5
77th " " " " ..... " "	90	20	12	"	slight down
Passing San Remo door..... " "	90	20	11.9	"	.....
" East End Spanish flats.... " W	90	32	7.5	"	3.5
67th St. & 8th Ave..... " N	90	25	9	"	.....
73rd " " " " ..... " "	90	20	11.4	"	.....
Passing San Remo door..... " "	90	20	11	"	.....
82nd St. & 8th Ave..... " "	90	28	8	"	.....
90th " " " " ..... " "	90	22	9.6	"	.....
103rd " " " " ..... " "	90	20	11.3	"	.....
110th " bet. Lenox & 7th Aves.... " E	90	18	15	M	slight down
106th " and 5th Ave..... " S	90	25	8.9	A	2.25
104th " " " " ..... " "	90	30	7.5	"	2.25
103rd " " " " ..... " "	90	32	7	"	2.25
101st " " " " ..... " "	90	30	7.5	"	1.5
99th " " " " ..... " "	90	30	7.5	"	1.5
97th " " " " ..... " "	90	31	7	"	1.75
94th " " " " ..... " "	89.5	35	6.4	"	2.75
82nd " " " " ..... " "	92	16	14	"	.....
Passing Synagogue door..... " "	92	16	13.8	"	.....
65th St. & 5th Ave..... " N	90	22	10	"	.....
67th " " " " ..... " "	89.5	26	8.5	"	2
69th " " " " ..... " "	89	32	7	"	2
Passing Lenox Library..... " "	90	24	9.8	"	.....
" Synagogue door..... " "	90	22	9.5	"	.....
82nd St. & 5th Ave..... " "	90	23	10	"	.....
87th " " " " ..... " "	89	32	7	"	2.5
110th " bet. Lenox & 7th Aves.... " W	90	27	7	M	slight up
107th " & 8th Ave..... " S	89.5	32	7	A	2.5
106th " " " " ..... " "	89.5	31	7.2	"	2.4
98th " " " " ..... " "	90	27	8.3	"	2.5
96th " " " " ..... " "	90	27	8.3	"	2.5
93rd " " " " ..... " "	90	26	8.3	"	2.5
77th " " " " ..... " "	90	20	12	"	slight down
65th " " 5th " ..... " N	90	22	10	"	.....
Voltage began to drop here. Ground covered to here a little over 20 miles. Time in motion a little over 2 hrs.					
68th St. & 5th Ave.....Going N	86	32	6.2	"	2.5
Passing Lenox Library..... " "	87	24	8.5	"	.....
" Synagogue door..... " "	87	25	8.5	"	.....
79th St. & 5th Ave..... " "	87	24	8.5	"	.....
84th " " " " ..... " "	87	24	9	"	.....
87th " " " " ..... " "	86	36	6.6	"	2.5
110th " bet. Lenox & 7th Aves..... " W	87	28	7	M	slight up
98th " & 8th Ave..... " S	87	26	6.8	A	2.5
95th " " " " ..... " "	87	26	8.2	"	2.5
87th " " " " ..... " "	89	18	10	A	slight down
76th " " " " ..... " "	88	19	11.4	"	.....
Passing San Remo.. ..... " "	88	19.5	11.4	"	.....
65th St. & 8th Ave..... " "	89	16	14.2	"	slight down
55th " " 5th " ..... " "	87	27	7.8	"	1
53rd " " " " ..... " "	87	26	7.8	"	1
40th " " " " ..... " "	87	20	9.8	"	.....
Ground covered to here, little over 27 miles. Time in motion a little over 2.8 hrs					

The average power consumption of vehicle A from Table II for a complete circle of the park, going north on Fifth Avenue, was 90.52 watt-hours per ton-mile. The average power consumption going north on Eighth Avenue was 90.99 watt-hours per ton-mile. Taking the average of these, we find 90.75 watt-hours per ton-mile to have been required for the propulsion of vehicle A over good asphalt pavement—with the exception of about .4 of a mile of bad cobble and macadam. Therefore, 90 watt-hours per ton-mile may be taken as possible under ordinary conditions for vehicle A on level asphalt in good condition. This for an average speed of 9.71 miles per hour.

It must be remembered in this latter connection that the ground covered included sections of two avenues which are usually very crowded. This was especially true of Eighth Avenue this spring, as a considerable portion of that part of it over which the vehicles traveled under test was being torn up for the laying of water pipes. This caused a great congestion of traffic. Fifth Avenue was also much crowded, especially in the afternoons. Therefore, the vehicles tested were very much hampered on nearly all occasions, and were

obliged to stop and slow up very often. This accounts for the slight discrepancies that may be noticed in the readings of the instantaneous power consumption taken while passing over the same ground with the same vehicle at different times. Thus, for example, note the readings in Table I, which show the instantaneous rate of power consumption obtained while passing Sixty-fifth Street and Fifth Avenue, going north. The voltmeter reading was 90, the ammeter reading 21, and the speed at the moment was at the rate of 10.3 miles per hour. Passing the same point in the same direction at another time, the voltmeter read 90 volts, the ammeter 22 amperes, while the tachometer at the moment showed the rate of speed to be but 10 miles per hour. This and similar discrepancies in readings are accounted for when it is remembered that at one time the vehicle probably had had an uninterrupted course for some time before it reached the point of reading, while at another it may have been obliged to stop or slow down just before reaching the point at which the reading was desired.

THE ADVANTAGE IN USING FRICTION-REDUCING DEVICES.

Having now seen what vehicle A was able to do under ordinary circumstances, it becomes of interest to know whether the results obtained were exceptional in any way, or whether they may be taken as representative of what may be required of electric vehicles in general under similar circumstances.

To determine this point, a number of vehicles of several other makes were tested over the same ground as vehicle A, under exactly

FIG. 2.—TESTING A RUNABOUT.

similar conditions. In Table III the results obtained while testing vehicle B are recorded. This vehicle was an electric delivery wagon designed for use in the same class of light delivery service as was vehicle A.

TABLE III.

[Vehicle B.]

Weight of vehicle	3,380 lbs.
Weight of passengers and instruments	334 lbs.
Weight of load carried	—
Total weight causing drawbar pull on test	3,714 lbs.
Battery equipment	40 cells
Weight of battery	1,250 lbs.
Per cent of battery weight to total weight of vehicle	36.98%
Per cent of battery weight to total weight causing drawbar pull	33.65%

Weather clear; no wind. Streets in good condition.

Principal ground covered on test: Fifth Avenue, from Fifty-ninth Street to 111th Street; Fifty-ninth Street, from Fifth Avenue to Eighth Avenue; 110th Street, from Fifth Avenue to Eighth Avenue; 111th Street, from Fifth Avenue to Eighth Avenue; Eighth Avenue, from Fifty-ninth Street to 111th Street.

Total distance covered during test	26.19 miles
Total time in motion	2 hr. 39 min. 30 sec.
Average speed while in motion	9.85 miles per hr.
Total watt-hours used on trip	3,808
Average watt-hours used per car-mile	145.4
Average watt-hours used per ton-mile	78.29

For a distance of	0.85 mile
Time in motion was	6 min.
Average speed while in motion	8.5 miles per hr.
Number of watt-hours used	129.6
Average watt-hours used per car-mile	152.47
Average watt-hours used per ton-mile	82.1
For a distance of	2.61 miles
Time in motion was	14 min.
Average speed while in motion	11.18 miles per hr.
Number of watt-hours used	396.8
Average watt-hours used per car-mile	152.03
Average watt-hours used per ton-mile	81.87
For a distance of	0.52 mile
Time in motion was	3 min. 30 sec.
Average speed while in motion	8.91 miles per hr.
Number of watt-hours used	19.2
Average watt-hours used per car-mile	38.85
Average watt-hours used per ton-mile	20.72
For a distance of	2.54 miles
Time in motion was	14 min.
Average speed while in motion	10.88 miles per hr.
Number of watt-hours used	432
Average watt-hours used per car-mile	170.08
Average watt-hours used per ton-mile	91.58
For a distance of	0.6 mile
Time in motion was	4 min.
Average speed while in motion	9 miles per hr.
Number of watt-hours used	129.6
Average watt-hours used per car-mile	216
Average watt-hours used per ton-mile	116.31
For a distance of	2.61 miles
Time in motion was	15 min. 30 sec.
Average speed while in motion	10.1 miles per hr.
Number of watt-hours used	356.8
Average watt-hours used per car-mile	136.66
Average watt-hours used per ton-mile	73.59
For a distance of	0.87 mile
Time in motion was	5 min. 30 sec.
Average speed while in motion	9.5 miles per hr.
Number of watt-hours used	86.4
Average watt-hours used per car-mile	99.31
Average watt-hours used per ton-mile	53.48
For a distance of	2.63 miles
Time in motion was	15 min. 30 sec.
Average speed while in motion	10.18 miles per hr.
Number of watt-hours used	404.8
Average watt-hours used per car-mile	153.91
Average watt-hours used per ton-mile	82.88
For a distance of	2.64 miles
Time in motion was	14 min.
Average speed while in motion	11.31 miles per hr.
Number of watt-hours used	342.4
Average watt-hours used per car-mile	129.69
Average watt-hours used per ton-mile	69.83
For a distance of	0.62 miles
Time in motion was	5 min. 30 sec.
Average speed while in motion	6.76 miles per hr.
Number of watt-hours used	145.6
Average watt-hours used per car-mile	234.83
Average watt-hours used per ton-mile	126.45
For a distance of	2.55 miles
Time in motion was	17 min.
Average speed while in motion	9 miles per hr.
Number of watt-hours used	396.8
Average watt-hours used per car-mile	155.6
Average watt-hours used per ton-mile	83.79
For a distance of	0.64 mile
Time in motion was	4 min.
Average speed while in motion	9.6 miles per hr.
Number of watt-hours used	57.6
Average watt-hours used per car-mile	90
Average watt-hours used per ton-mile	48.46
For a distance of	2.63 miles
Time in motion was	15 min.
Average speed while in motion	10.52 miles per hr.
Number of watt-hours used	336
Average watt-hours used per car-mile	127.75
Average watt-hours used per ton-mile	68.79
For a distance of	0.6 mile
Time in motion was	5 min. 30 sec.
Average speed while in motion	6.54 miles per hr.
Number of watt-hours used	144
Average watt-hours used per car-mile	240
Average watt-hours used per ton-mile	129.24
For a distance of	2.65 miles
Time in motion was	16 min.
Average speed while in motion	9.93 miles per hr.
Number of watt-hours used	368
Average watt-hours used per car-mile	138.86
Average watt-hours used per ton-mile	74.77
For a distance of	0.63 mile
Time in motion was	4 min. 30 sec.
Average speed while in motion	8.4 miles per hr.
Number of watt-hours used	62.4
Average watt-hours used per car-mile	99.04
Average watt-hours used per ton-mile	53.33
Open circuit voltage at beginning of run	85 volts
Open circuit voltage at end of run	77.5 volts
Drop in 26.19 miles	7.5 volts
Running voltage at beginning of run	76 volts
Running voltage at end of run	66.5 volts
Drop in 26.19 miles	9.5 volts

From Table III it will be noted that vehicle B covered 26.19 miles with an average rate of power consumption of 78.29 watt-hours per ton-mile. The average speed was 9.85 miles per hour. The open

circuit voltage at the end of the run was 1.93 volts per cell, and the running voltage was 1.66 volts. The maximum rate of power consumption noted was 129.24 watt-hours per ton-mile. This rate of power consumption was recorded on a run of .6 of a mile, from Fifth Avenue and 111th Street to Eighth Avenue and 110th Street. This particular part of the ground covered on this test included bad cobble pavement, a small grade and some bad macadam road surface. The speed on this section was only 6.54 miles per hour.

For the same section on another trip in the same direction, vehicle B showed a rate of power consumption of 126.45 watt-hours per ton mile at a speed of 6.76 miles per hour, which is at practically the same rate; and the results confirm the accuracy of those first obtained.

Over 24.5 miles of this run was around Central Park. Table IV gives the result of two complete circles around the park in opposite directions.

TABLE IV.

[*Vehicle B.*]

Once around Central Park—North on Fifth Avenue, south on Eighth Avenue.

For a distance of	6.45 miles
Time in motion was	40 min. 30 sec.
Average speed while in motion	9.55 miles per hr.
Number of watt-hours used	942.4
Average watt-hours used per car-mile	146.1
Average watt-hours used per ton-mile	78.62

Once around Central Park—North on Eighth Avenue, south on Fifth Avenue.

For a distance of	6.27 miles
Time in motion was	35 min. 30 sec.
Average speed while in motion	10.59 miles per hr.
Number of watt-hours used	977.6
Average watt-hours used per car-mile	155.91
Average watt-hours used per ton-mile	83.95

The discrepancy in distance that will be noted between the trip of vehicle B around the park, going north on Fifth Avenue, and for

FIG. 3.—ON FIFTH AVENUE.

the same trip as noted in Table II for vehicle A, is due to the fact that vehicle B on this trip went through 111th Street, instead of 110th Street.

The average of the two circles around the park noted in Table IV gives 81.28 as the average rate of power consumption required to propel vehicle B around the park on good pavement—with the exception of the .6 of a mile of bad road surface noted above. So it is thought 80 watt-hours per ton-mile may be taken as a possible rate of power consumption for vehicle B on level asphalt in good condition for an average speed of 10 miles per hour.

A comparison of the results obtained from Tables II and IV shows that vehicle A required 90 watt-hours per ton-mile to propel it on level asphalt, while vehicle B required but 80. Hence it would seem as though the results obtained while testing vehicle A are in no way exceptional, and may be taken as representative of what may be expected of well-designed electric vehicles in general under similar circumstances.

Both vehicles A and B were equipped with solid rubber tires, and the ratio of the weights of their batteries and passengers to the weights of the vehicles as units was practically the same. The wheels of each vehicle were equipped with ball-bearings. The armature shaft on vehicle B was also equipped with ball-bearings. This was not the case with vehicle A, which would seem to indicate, as might be expected, that there is a saving in power consumption where ball-bearings or other friction reducing devices are used at all possible points.

A TEST WITHOUT FRICTION-REDUCING DEVICES.

That this is the case, the results presented in Table V seem to confirm. In this table the results obtained while testing a vehicle designed for use in the same class of light delivery service as vehicles A and B are given. This vehicle was equipped with solid rubber tires, as were the others; but, unlike them, it had no ball-bearings or other friction reducing equipment at all—the wheels and motor shafts running in plain bearings.

TABLE V.

[*Vehicle C.*]

Weight of vehicle	4,190 lbs.
Weight of passengers and instruments	335 lbs.
Weight of load carried	—
Total weight causing drawbar pull on test	4,525 lbs.
Battery equipment	44 cells
Weight of battery	1,200 lbs.
Per cent of battery weight to total weight of vehicle	28.63%
Per cent of battery weight to total weight causing drawbar pull	26.51%

Principal ground covered on test: Fifth Avenue, from Twentieth Street to 111th Street; Fifty-ninth Street, from Fifth Avenue to Eighth Avenue; 111th Street, from Fifth Avenue to Eighth Avenue; Eighth Avenue, from Fifty-ninth Street to 111th Street; Twenty-first Street, from Seventh Avenue to Fifth Avenue.

Total distance covered during test	24.75 miles
Total time in motion	2 hr. 47 min. 54 sec.
Average speed while in motion	8.83 miles per hr.
Total watt-hours used	5,316.8
Average watt-hours used per car-mile	214.82
Average watt-hours used per ton-mile	94.92
For a distance of	2.38 miles
Time in motion was	18 min. 54 sec.
Average speed while in motion	7.55 miles per hr.
Number of watt-hours used	561.6
Average watt-hours used per car-mile	235.96
Average watt-hours used per ton-mile	104.22
For a distance of	2.62 miles
Time in motion was	15 min. 30 sec.
Average speed while in motion	10.14 miles per hr.
Number of watt-hours used	494.4
Average watt-hours used per car-mile	188.7
Average watt-hours used per ton-mile	83.11
For a distance of	0.55 mile
Time in motion was	5 min.
Average speed while in motion	6.66 miles per hr.
Number of watt-hours used	220.8
Average watt-hours used per car-mile	401.45
Average watt-hours used per ton-mile	177.39
For a distance of	2.6 miles
Time in motion was	17 min.
Average speed while in motion	9.17 miles per hr.
Number of watt-hours used	579.2
Average watt-hours used per car-mile	222.77
Average watt-hours used per ton-mile	98.44
For a distance of	0.63 mile
Time in motion was	3 min. 30 sec.
Average speed while in motion	10.8 miles per hr.
Number of watt-hours used	80
Average watt-hours used per car mile	127
Average watt-hours used per ton-mile	56.12
For a distance of	0.68 mile
Time in motion was	4 min. 45 sec.
Average speed while in motion	8.58 miles per hr.
Number of watt-hours used	200
Average watt-hours used per car-mile	294.11
Average watt-hours used per ton-mile	129.96
For a distance of	2.61 miles
Time in motion was	15 min. 45 sec.
Average speed while in motion	9.94 miles per hr.
Number of watt-hours used	472
Average watt-hours used per car-mile	180.84
Average watt-hours used per ton-mile	79.91
For a distance of	0.58 mile
Time in motion was	4 min. 30 sec.
Average speed while in motion	7.73 miles per hr.
Number of watt-hours used	97.6
Average watt-hours used per car-mile	168.27
Average watt-hours used per ton-mile	74.35
For a distance of	2.57 miles
Time in motion was	16 min. 30 sec.
Average speed while in motion	9.34 miles per hr.
Number of watt-hours used	588.8
Average watt-hours used per car-mile	229.1
Average watt-hours used per ton-mile	101.23
For a distance of	2.67 miles
Time in motion was	15 min.
Average speed while in motion	10.68 miles per hr.
Number of watt-hours used	489.6
Average watt-hours used per car-mile	183.37
Average watt-hours used per ton-mile	81.02

For a distance of.....0.61 mile
Time in motion was.....5 min.
Average speed while in motion.....7.32 miles per hr.
Number of watt-hours used.....216
Average watt-hours used per car-mile.....354.09
Average watt-hours used per ton-mile.....156.46

For a distance of.....2.55 miles
Time in motion was.....18 min.
Average speed while in motion.....8.5 miles per hr.
Number of watt-hours used.....576
Average watt-hours used per car-mile.....225.88
Average watt-hours used per ton-mile..... 99.81

For a distance of.....3.7 miles
Time in motion was.....28 min. 30 sec.
Average speed while in motion.....7.78 miles per hr.
Number of watt-hours used.....740.8
Average watt-hours used per car-mile.....200.21
Average watt-hours used per ton-mile..... 88.47
Open circuit voltage at beginning of run.....90 volts
Open circuit voltage at end of run.....84 volts

Drop in 24.75 miles..... 6 volts

Running voltage at beginning of run.....85 volts
Running voltage at end of run.....78 volts

Drop in 24.75 miles..... 7 volts

Vehicle C, therefore, from Table V, traveled 24.75 miles with an average rate of power consumption of 94.92 watt-hours per ton-mile at an average speed of 8.83 miles per hour. The open circuit voltage at the end of the run was over 1.9 volts per cell, and the running voltage over 1.77 volts per cell. The maximum rate of power consumption was recorded over the .6 of a mile of bad cobble and macadam in 111th Street, as was the case in the test on Vehicle B. This maximum was 177.39 watt-hours per ton mile. It is 20.93 watt-hours higher than the 156.46 watt-hours per ton-mile rate noted for this vehicle over the same ground in the same direction at another time. The latter rate was obtained while traveling under more normal conditions, and it is thought is more accurate.

Over 18 miles of this test was around the park, and Table VI shows the results of two complete circles of it.

TABLE VI.
[*Vehicle C.*]

Once around Central Park—North on Fifth Avenue, south on Eighth Avenue.

For a distance of.....6.4 miles
Time in motion was.....41 min.
Average speed while in motion.....9.36 miles per hr.
Number of watt-hours used.....1,374.4
Average watt-hours used per car-mile.....214.75
Average watt-hours used per ton-mile..... 95.02

Once around Central Park—North on Eighth Avenue, south on Fifth Avenue.

For a distance of.....6.44 miles
Time in motion was.....40 min. 50 sec.
Average speed while in motion.....9.46 miles per hr.
Number of watt-hours used.....1,358.4
Average watt-hours used per car-mile..... 214.03
Average watt-hours used per ton-mile..... 94.7

From Table VI, the average of the two trips around the park shows a rate of power consumption of practically 95 watt-hours per ton-mile for level asphalt, as against 90 watt-hours per ton-mile for vehicle A, and 80 watt-hours per ton-mile for vehicle B. This bears out conclusively the contention that it is necessary to use friction-reducing mechanisms at all possible points in order to get the lowest rate of power consumption.

Some manufacturers, however, consider that the saving in power consumption thus effected is offset by the disadvantages which arise from the use of the increased number of parts required and the greater liability of the mechanism to get out of order; thus causing a higher rate of depreciation and increasing the initial cost as well as the cost of repairs. Another disadvantage arising from this complication of parts, it is contended, is that the time and labor required to keep the vehicle in proper running order is much greater than when the simpler mechanism is employed.

THE ADVANTAGES OF A LIGHT VEHICLE.

In Tables I, III and V it will be noted that the average watt-hours used per car-mile were, respectively, 155.27 watt-hours, 145.4 watt-hours and 214.82 watt-hours, which clearly indicate the advantage of a light vehicle from the point of view of its rate of power consumption. As these vehicles were all designed to carry practically the same load, it follows that so far as operating expenses are concerned, the lighter vehicles are better adapted to the service required of them.

Plate I shows six curves which represent the values of the open circuit voltage and running voltage at different points plotted from the readings taken while testing vehicles A, B and C, as already noted. The ordinates are volts and the abscissæ miles.

A consideration of the curves in this plate shows that the battery in vehicle A had reached the steep part of its discharge curve at the end of the run noted in Table I, and that but a short distance farther could have been traveled by the vehicle without recharging the battery. The curves for the other two vehicles, however, indicate that

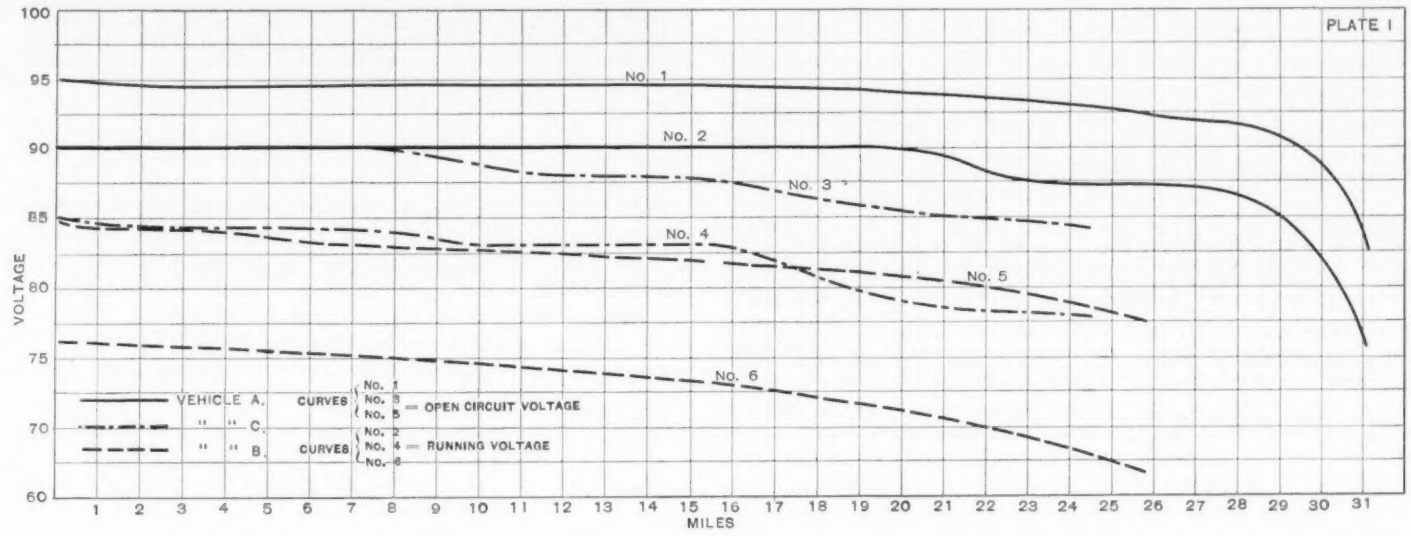


PLATE I.

a few more miles might still have been covered by them without recharging.

It may be noted that on the completion of 22 miles of its run, the open circuit voltage of the battery in vehicle A was still above 2.12 volts per cell, and that its running voltage was still above 2 volts per cell. In the case of vehicle B, the open circuit voltage of its battery was still above 2 volts per cell, and its running voltage was still above 1.75 volts per cell for the same distance. The battery of vehicle C showed an open circuit voltage of over 1.9 volts per cell and a running voltage of over 1.78 volts per cell. Therefore, at the end of a 22-mile run all the batteries were in very good shape.

Plate II shows six curves for the same vehicles and for the same tests as represented by the curves in Plate I, but plotted in this case with volts as ordinates and time as abscissæ. The same scale is used in both plates, which gives an opportunity for direct comparison. It will be noted that the general form of the curves in both cases is almost identical.

TEST ON A LOADED VEHICLE.

So far the tests considered were made on vehicles that carried no load except that caused by two passengers and the instruments used for testing purposes. The question which suggests itself in this connection is, Will the addition of a "load" in any way affect conclusions based on results obtained while testing vehicles without loads?

To determine this important point, vehicle A was loaded and a test was made which covered part of the same ground covered on other

tests with vehicle A unloaded under identical conditions. Table VII gives the results obtained on this run.

TABLE VII.

[*Vehicle A.*]

Weight of vehicle	3,085 lbs.
Weight of passengers and instruments	305 lbs.
Weight of load carried	625 lbs.
Total weight causing drawbar pull on test	4,015 lbs.
Per cent of battery weight to total weight of vehicle	36.3%
Per cent of battery weight to total weight causing drawbar pull	27.89%

Principal ground covered on test: Fifth Avenue, from Fifty-ninth Street to 110th Street; Fifty-ninth Street, from Fifth Avenue to Eighth Avenue; 110th Street, from Fifth Avenue to Eighth Avenue; Eighth Avenue, from Twentieth Street to 110th Street; Twenty-first Street, from Seventh Avenue to Eighth Avenue; Broadway, from Forty-second Street to 120th Street.

Total distance covered on test	17.44 miles
Total time in motion	1 hr. 59 min. 55 sec.
Average speed while in motion	8.72 miles per hr.
Total watt-hours used on trip	3,249.6
Average watt-hours used per car-mile	186.33
Average watt-hours used per ton-mile	92.81
For a distance of	1.23 miles
Time in motion was	11 min. 30 sec.
Average speed while in motion	6.41 miles per hr.
Number of watt-hours used	203.2
Average watt-hours used per car-mile	165.2
Average watt-hours used per ton-mile	82.29
For a distance of	2.7 miles
Time in motion was	21 min. 30 sec.
Average speed while in motion	7.53 miles per hr.
Number of watt-hours used	534.4
Average watt-hours used per car-mile	197.92
Average watt-hours used per ton-mile	98.59
For a distance of	2.57 miles
Time in motion was	16 min. 20 sec.
Average speed while in motion	9.44 miles per hr.
Number of watt-hours used	414.4
Average watt-hours used per car-mile	161.24
Average watt-hours used per ton-mile	80.31
For a distance of	0.53 mile
Time in motion was	4 min. 30 sec.
Average speed while in motion	7.06 miles per hr.
Number of watt-hours used	158.4
Average watt-hours used per car-mile	298.86
Average watt-hours used per ton-mile	148.87
For a distance of	2.61 miles
Time in motion was	18 min.
Average speed while in motion	8.7 miles per hr.
Number of watt-hours used	544
Average watt-hours used per car-mile	208.42
Average watt-hours used per ton-mile	103.82
For a distance of	3.32 miles
Time in motion was	22 min. 5 sec.
Average speed while in motion	9.02 miles per hr.
Number of watt-hours used	657.6
Average watt-hours used per car-mile	198.07
Average watt-hours used per ton-mile	98.66
For a distance of	4.48 miles
Time in motion was	26 min.
Average speed while in motion	10.33 miles per hr.
Number of watt-hours used	737.6
Average watt-hours used per car-mile	164.64
Average watt-hours used per ton-mile	82.01
Open circuit voltage at beginning of run	97 volts
Open circuit voltage at end of run	92 volts
Drop in 17.44 miles	5 volts
Running voltage at beginning of run	91 volts
Running voltage at end of run	86 volts
Drop in 17.44 miles	5 volts

From Table VII it will be seen that the watt-hours per ton-mile required by vehicle A remained practically the same whether it was loaded or not. Therefore, all conclusions based on tests on unloaded vehicles, it would seem, hold true when considering vehicles carrying a load.

FIG. 4.—A VIEW OF THE RECORDING APPARATUS.

From Table I the average watt-hours per ton-mile required by vehicle A to cover a distance of 31.51 miles were 91.6. From Table VII the average watt-hours per ton-mile for 17.44 miles required by vehicle A, with a load, were 92.81, practically identical results, as the run of Table VII included a little more hill work than that of Table I, which accounts for the difference shown.

Comparing the results obtained while traveling over the same ground with vehicle A loaded and unloaded, it is found that the watt-hours per ton-mile for the average of two runs over the same ground unloaded give 80.27 watt-hours per ton-mile at a speed of 10 miles per hour, while the watt-hours per ton-mile for the vehicle with a load were 80.31 at a speed of 9.44 miles per hour—a closer agreement even than was noted above. The average watt-hours per car-mile for this section of the unloaded run were 136.12; for the same section of the loaded run, 161.24.

It will be noticed in Table VII that though the average watt-hours used per car-mile by vehicle A while carrying a load were 186.33,

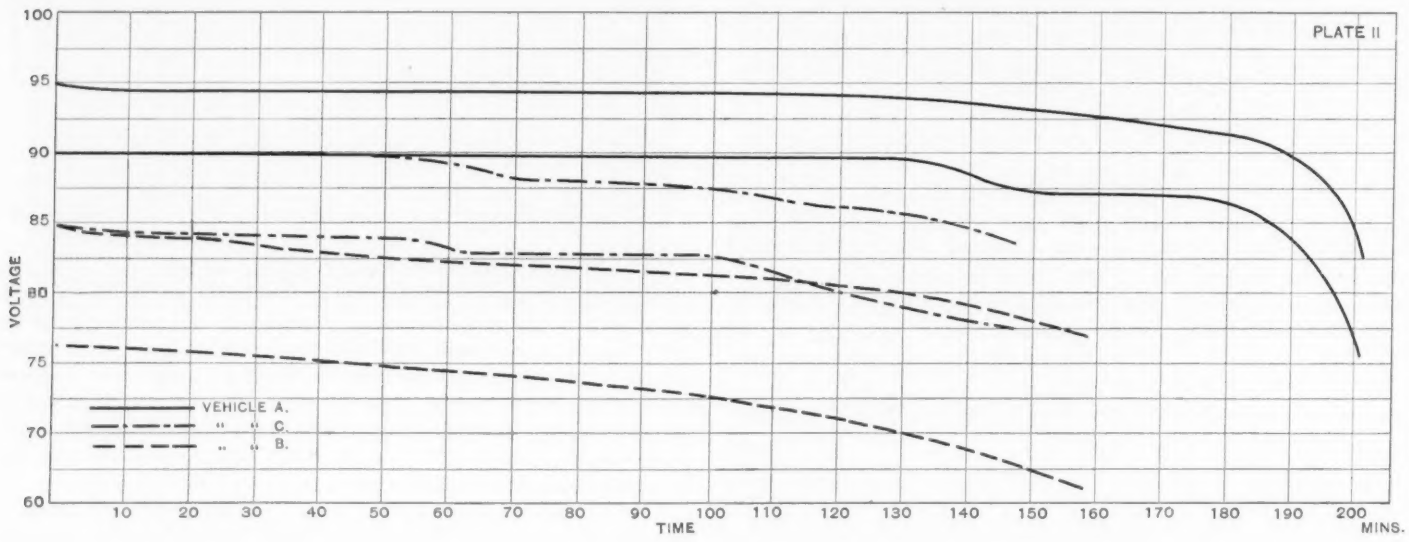


PLATE II.

this rate is still not as high as that shown in Table V for vehicle C without a load, which emphasizes the point already referred to, that for the same class of service, from a commercial point of view, the lighter vehicle is better adapted to its work.

PNEUMATIC TIRES VS. SOLID TIRES.

So far all the vehicles considered were equipped with solid rubber tires. To determine if any considerable difference in power consumption results when pneumatic tires are used, vehicle A was equipped with wheels on which were 4-in. pneumatic tires. These replaced front wheels on which were 2-in. solid rubber tires, and back wheels on which the solid tires were 2.5 ins. Table VIII gives the result of this test.

TABLE VIII.

[*Vehicle A.*]

Weight of vehicle	3,050 lbs.
Weight of passengers and instruments	305 lbs.
Weight of load carried	—
Total weight causing drawbar pull on test	3,355 lbs.
Per cent of battery weight to total weight of vehicle	36.72%
Per cent of battery weight to total weight causing drawbar pull	33.38%

Principal ground covered on test: Fifth Avenue, Forty-second Street to 110th Street; 110th Street, Fifth Avenue to Seventh Avenue; Eighth Avenue, Forty-second Street to 149th Street; Seventh Avenue, 110th Street to 154th Street; Macombs Lane, 154th Street to 149th Street.

Total distance covered during test	12.85 miles
Total time in motion	1 hr. 21 min. 45 sec.
Average speed while in motion	9.43 miles per hr.
Total watt-hours used on trip	2,252.8
Average watt-hours used per car-mile	175.32
Average watt-hours used per ton-mile	104.51
For a distance of	1.43 miles
Time in motion was	9 min. 30 sec.
Average speed while in motion	9.03 miles per hr.
Number of watt-hours used	246.4
Average watt-hours used per car-mile	172.3
Average watt-hours used per ton-mile	102.71
For a distance of	2.56 miles
Time in motion was	15 min.
Average speed while in motion	10.24 miles per hr.
Number of watt-hours used	384
Average watt-hours used per car-mile	150
Average watt-hours used per ton-mile	89.42
For a distance of	0.4 mile
Time in motion was	4 min.
Average speed while in motion	6 miles per hr.
Number of watt-hours used	91.2
Average watt-hours used per car-mile	228
Average watt-hours used per ton-mile	135.91
For a distance of	2.04 miles
Time in motion was	13 min.
Average speed while in motion	9.42 miles per hr.
Number of watt-hours used	396.8
Average watt-hours used per car-mile	194.5
Average watt-hours used per ton-mile	115.94
For a distance of	2.5 miles
Time in motion was	15 min. 30 sec.
Average speed while in motion	9.67 miles per hr.
Number of watt-hours used	608
Average watt-hours used per car-mile	243.2
Average watt-hours used per ton-mile	144.98
For a distance of	2.56 miles
Time in motion was	15 min. 30 sec.
Average speed while in motion	9.9 miles per hr.
Number of watt-hours used	310.4
Average watt-hours used per car-mile	121.25
Average watt-hours used per ton-mile	72.28
For a distance of	1.36 miles
Time in motion was	9 min. 15 sec.
Average speed while in motion	8.82 miles per hr.
Number of watt-hours used	216
Average watt-hours used per car-mile	158.82
Average watt-hours used per ton-mile	94.67
Open circuit voltage at beginning of run	98.5 volts
Open circuit voltage at end of run	94 volts
Drop in 12.85 miles	4.5 volts
Running voltage at beginning of run	90 volts
Running voltage at end of run	89 volts
Drop in 12.85 miles	1 volt

From Table VIII it will be seen that the average watt-hours per ton-mile were 104.51 for vehicle A with pneumatic tires on for a distance of 12.85 miles. This is a much higher rate of power consumption than was required by this vehicle with solid tires on. Owing to the nature of some of the ground covered on this trip, the result noted above cannot be used for direct comparison. Part of this test, however, was over the same ground previously covered by the vehicle under identical conditions, with the exception that solid tires were used. A comparison of the results obtained while traveling over this ground, first with solid tires and then with pneumatics, gives the rate of power consumption for solid tires as 80.27 watt-hours per ton-mile, as against 89.42 watt-hours per ton-mile with pneumatics, at practically the same speed.

It may be assumed, therefore, that vehicles equipped with pneumatic tires will show a slightly increased rate of power consumption over those equipped with solid tires.

THE EFFECT OF MACADAM ROAD SURFACE.

Part of the test recorded in Table VIII was over a macadam road surface, and the rate of power consumption while traveling over this section of the route was 115.94 watt-hours per ton-mile.

For a distance of 2.5 miles, which included some macadam road surface, cobbles, a sandy stretch of road, a slight grade and some asphalt, the average rate of power consumption noted was 144.98 watt-hours per ton-mile, and for a distance of .4 of a mile over cobbles and bad macadam the rate of power consumption was 135.91 watt-hours per ton-mile. This accounts, in some measure, for the high average rate of power consumption recorded for the trip. Even with such a high rate of power consumption, however, as is shown for nearly half the distance covered, the total average watt-hours used per car-mile were only 104.51.

All the tests noted to this point were made under ideal weather conditions, and the greater part of each run was over good asphalt pavement. Therefore, the results so far may be looked upon as representing the best that can be expected of electric vehicles under ordinary commercial conditions in New York City to-day at this present early stage in their development. We shall next consider bad weather conditions.

Mississippi Independent Telephone Association.

A very interesting meeting of the independent telephone companies of Mississippi was held at Aberdeen, Miss., on Sept. 19 and 20, when the Mississippi Independent Telephone Association elected the following officers: Hugh Campbell, president, Aberdeen; L. B. Camp, vice-president, Amory; A. W. Kearley, secretary and treasurer, Boonville; C. W. Bolton, assistant secretary and treasurer, Pontotoc. The above officers also constitute the executive board of the association. The "Maltese Cross" sign was adopted as the emblem of the association, and the members of the association are requested to have it printed on their telephone stationery. The members of the association are to report quarterly to the secretary all changes and improvements in their business and all matters of special interest to the telephone people that may occur in their section of country. The secretary is to make a report of all such items of interest to the members of the association at the close of each quarter. A membership fee of $1 annually will be charged to each member actually engaged in or interested in the independent telephone business in Mississippi. A membership fee of $5 will be charged to any manufacturer or dealer in telephones and material. The time and place of holding the next meeting will be decided later by the executive board of the association. Mr. La Bourveau, representing the Sumter Telephone Manufacturing Company, attended the meeting with an exhibit of its telephones and switchboards. Reports showed rapid advancement in the telephone (independent) business in Mississippi. There are twenty-six independent exchanges in Mississippi and many hundreds of miles of good toll lines. These lines and exchanges are being rapidly extended and connected. The "independents" are also equipping their lines and exchanges with the latest improved and best telephones and switchboards to be had.

Buying an Underground Road.

A cable message from London of Sept. 29 to the press contains the following interesting news: Charles T. Yerkes, of Chicago and New York, was yesterday elected chairman of the new board of directors of the Charing Cross, Euston and Hampstead Underground Railroad. The formalities were completed in a few minutes. Mr. Yerkes handed a check for £100,000 to the old company, representing £40,000 for the charter and £60,000, which is the amount the old company had deposited with the authorities as a guarantee for carrying out the work. A. A. Housman was elected treasurer and H. C. Davis secretary of the board of directors. The former will receive £10,000 for negotiating the deal.

A Combination Lighting and Traction Plant, Southport, England.

HAVING operated an electric light plant for some time past, the town of Southport, England, has now added a trolley system, and operates both from the one plant. The plant does not, however, follow the method now popular in this country of generating only one type of current for all types of service, with the aid of statics, rotaries, etc., but has distinct apparatus for each class of supply. There are, however, many details about the apparatus that are of general interest. Current is generated at 2000 volts single-phase alternating for illumination, transformed down to 100 and 200 volts, for two-wire networks fed from sub-stations, and the trolley road is run with a 500-volt continuous-current generator.

The generating plant illustrated in Fig. 1 is two miles from the centre of the supply district, and one interesting feature is the contrast presented by the revolving field and stationary field types of Ferranti alternators. There are three of the former and one of the latter, the machines with the stationary field type having been the last to be erected. The first two machines erected were put down in 1895 and 1896. They are rated at 125 kilowatts, and, as seen in Fig. 1, are of the fly-wheel type and driven by cross-compound Corliss condensing engines by Musgrave & Co. The third machine is a 300 kilowatt machine, also driven by a Musgrave engine. The armature winding of this machine is composed of stranded copper insulated by a cotton covering and braiding, and is carried through the laminated iron core in micanite tubes, the end of the winding and connections being protected from damage and dirt by German silver boxes lined with ebonite. The armature is connected in series and is lap-wound. The laminated iron core itself is built in sections which, with the winding and the protecting end boxes, can easily be removed and replaced by a complete spare section. The armature, as a whole, is securely held in a strong cast-iron frame, which rests on feet and is bolted to strong girders embedded in the concrete foundations. The field magnets are oval, and are fixed in the periphery of a cast-iron fly-wheel, and securely held in position by bolts passing through the rim. The field winding is of the usual form of copper strip wound on edge, and takes current from a small Parker exciter, driven by ropes off a pulley on the main shaft.

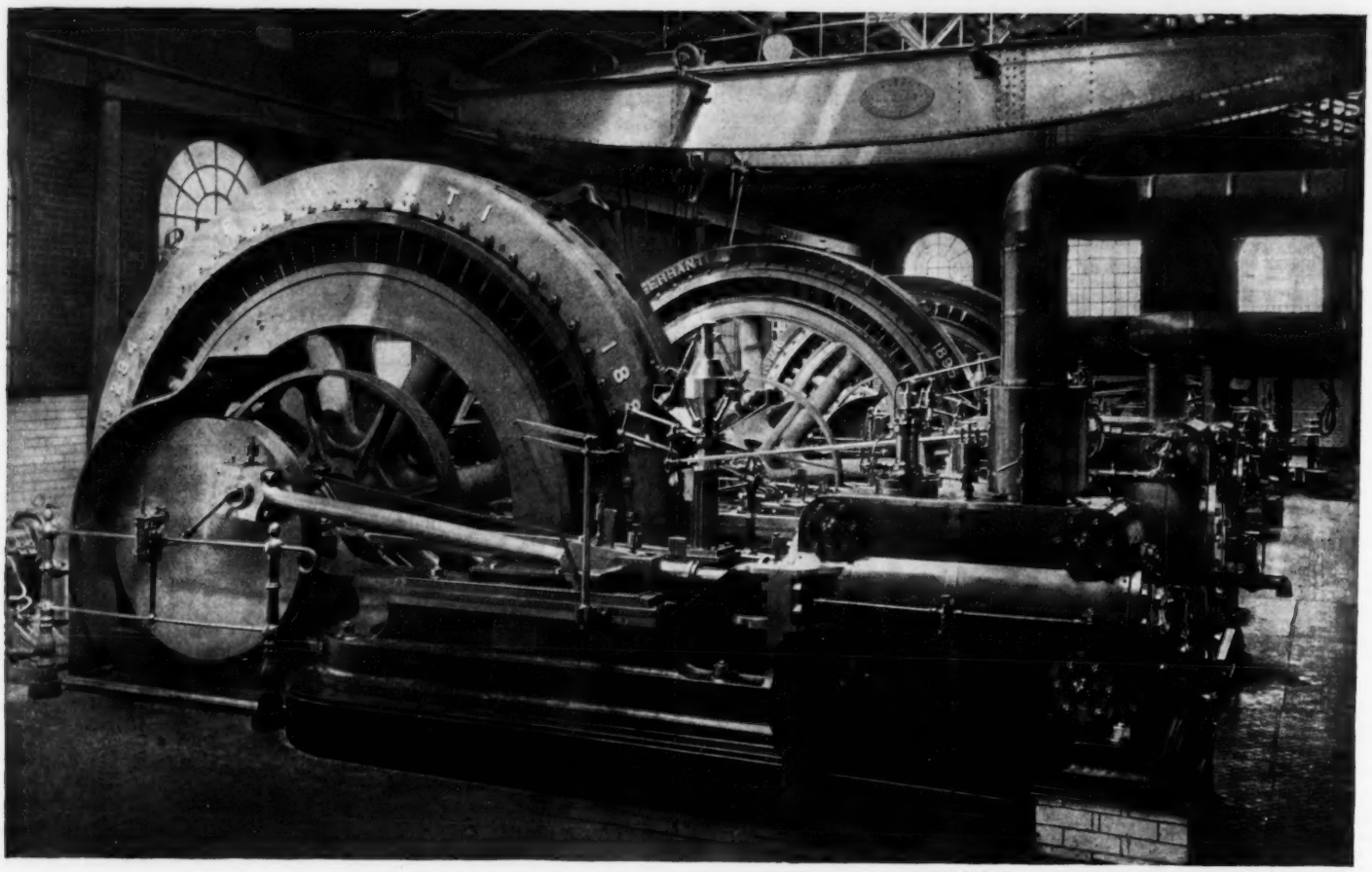


FIG. 1.—INTERIOR VIEW OF GENERATING PLANT, SOUTHPORT.

The Ferranti revolving armature alternator is designed to give 286 amperes at 2100 volts, its frequency being the same as that of the others, namely, 50 per second. All the machines are operated in parallel, the "iron" types running quite harmoniously with the "copper" ones. A diagram of the Ferranti "copper" armature is given in Fig. 9. The wheel on which the armature is mounted is made in one casting, and is of ample strength to stand the stresses set up when running at 214 r. p. m. It is secured to the shaft by mild steel rings shrunk over the bosses. The shaft on which the wheel is mounted is separate from the crank shaft, but coupled to it by a solid forged flange. The armature, consisting of 28 coils, is wound on cores built up in alternate layers of strips of brass and asbestos. It is of the usual form of Ferranti corrugated copper strip, which insures the winding being kept securely in position. Each pair of coils is firmly held between, but insulated from, machined gun-metal holders which are rivetted together. Connected with bosses on these carriers are steel bolts, which, after passing through the outside of the wheel rim, screw into cast-iron blocks, which are themselves embedded in a special sulphur compound run into cored pockets in the wheel rim. In order to secure good insulation, the bolts carrying the holders are covered with ebonite before being placed in position. The manner in which the armature is connected up in two parallel halves is shown in Fig. 9. The construction of the collector gear is simple and efficient, and the current, after passing down specially-insulated connections, is collected off a gun-metal ring which is carried by, but insulated from, the wheel boss. On each side of the armature, allowing an air-gap of about three-eights of an inch, are ranged the 28 poles, which are fixed into bored holes in the cast-iron yoke which itself forms part of the massive frame. To facilitate easy adjustment of the air-gap and to reduce the friction in opening the two halves for purposes of cleaning or inspection, the feet of the frames are mounted on rollers.

The field winding is of the usual construction and composed of copper strips wound on edge around each pole. It receives the current from the armature of a rope-driven exciter. A special precaution against a flash-over from the armature to poles is taken by placing micanite caps on the faces, which also allows the air-gap to be made smaller than would otherwise be possible. This machine is driven by a vertical three-crank tandem compound Musgrave engine with Corliss valves, four to each cylinder, actuated in this case by a piston gear

instead of by a trip gear. The speed of 214 r. p. m. is fairly high for this type of valve. The exciter is of the same type as on the other dynamos, and driven in the same way. Each of the three parts of the engine is complete in itself, with its own jet condenser, so that in the case of one set of cylinders being disabled the machine may in certain circumstances still be kept running.

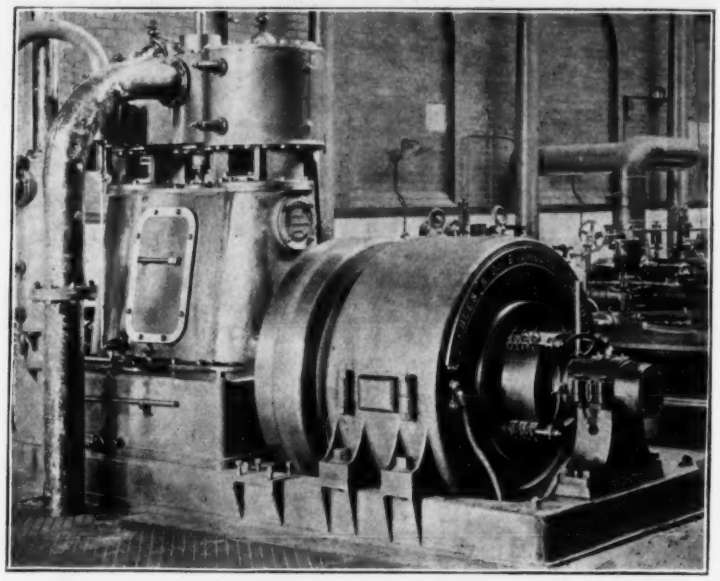


FIG. 2.—PEEBLES DYNAMO.

Fig. 3 is a view of the Ferranti switchboard, with edgewise ammeters, single-pole quick-break switches, oil-bath fuses and the usual field rheostats, with a large number of stops and extra switches. In a room behind the switchboard are three pieces of auxiliary apparatus. One is a Fuller-Wenstrom motor of 35 horse-power connected to the condensing water pump, and the other two are Cowan alternate-current boosters, which will boost up the high pressure supplied to a circuit by 150 volts (at 100 amperes) if necessary. The primary of these is connected across the terminals of the alternator, and the secondary is in series with the circuit. The secondary coil is placed on a

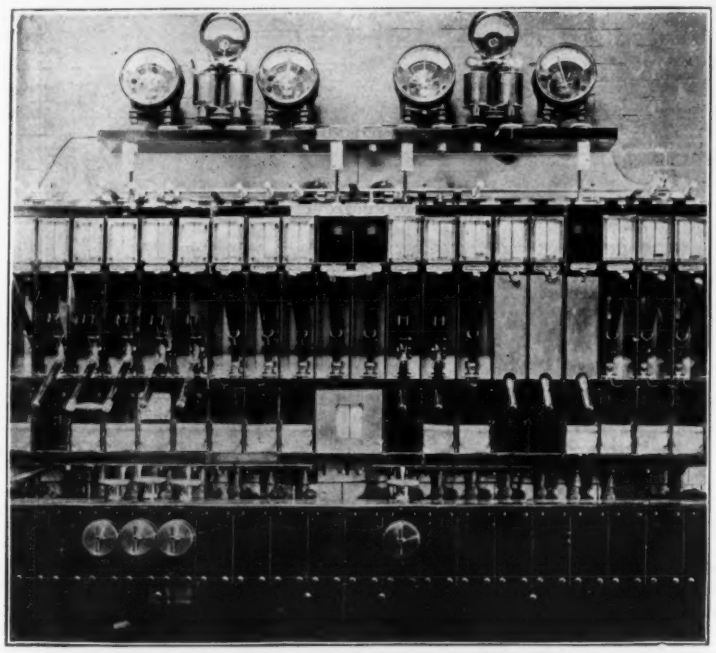


FIG. 3.—FERRANTI SWITCHBOARD.

shaft so that the relative position of the two coils can be adjusted to vary the secondary pressure.

The arc lighting is done by Ferranti rectifiers, there being in all 42 15-ampere arcs. There are two rectifiers, but each is capable of taking the full load of arc lamps. Fig. 5 shows the arc lighting on the promenade facing the sea.

Coming to the trolley system, it may be noted that only one of the three proposed continuous-current sets has been put down up to the present. They are Peebles dynamos (Fig. 2), driven by Beliss engines. The engines are rated at 375 B. H. P., with a steam pressure of 130 lbs. per square inch at the stop valve, with 100 degs. of superheat, and running at 350 r. p. m. When running condensing, as at Southport, the steam consumption per kilowatt is guaranteed at 28 lbs. The 200-kw compound-wound dynamo, generating current at a pressure of from 500 to 550 volts, is four-pole, with a drum armature and carbon brushes. The chief feature is the pole-pieces, shown in Fig. 8. The leading horn has a small cast-steel projection bolted to it with the object of securing complete sparklessness of the brushes. The armatures are slot wound and fitted to spiders of rigid design and thoroughly ventilated. The efficiency of the combined set is stated to be 89 per cent at full load.

The street railway switchboard, shown in Fig. 7, had to be built in an angle of the building, and this has proved a most convenient arrangement. Dorman & Smith have supplied this part of the plant. It is built up of polished slate panels mounted on a skeleton frame of T-iron. On the right are three generator panels, each with an ammeter, a voltmeter, the hand-wheel of the shunt rheostat and three double-break switches—equalizer, + and — respectively. The next two panels are for the insulated rail feeders, both of which come from the same point of the tramway system. On these panels are four ammeters (two of which are spare), two voltmeters with plugs

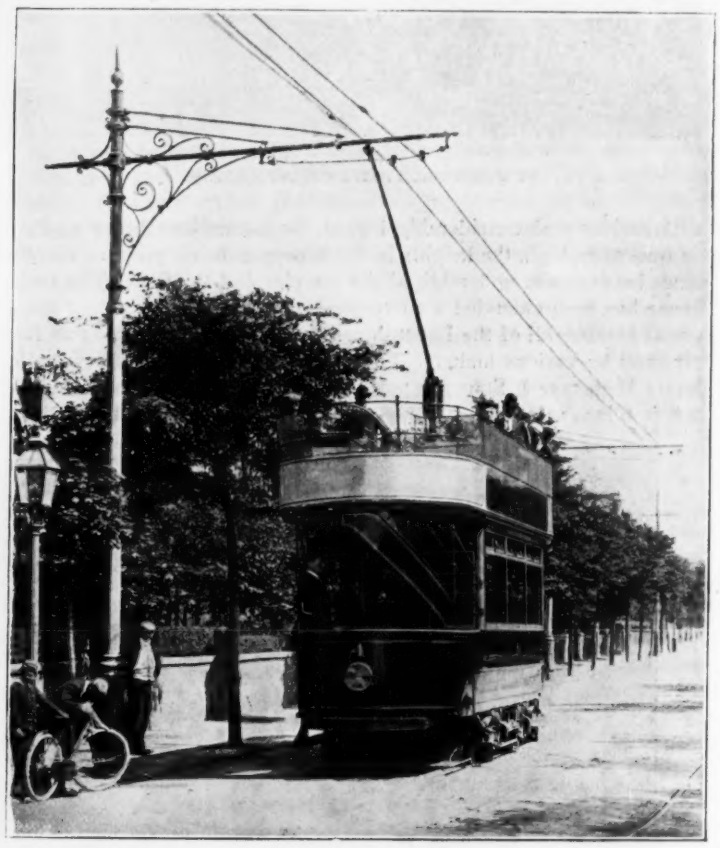


FIG. 4.—LINE CONSTRUCTION.

for connecting them to any circuit, and two recording wattmeters, one for the current leaving the bus-bars, the other to record the energy used for lighting the plant. The two centre panels are for the Board of Trade instruments, with the exception of the upper half of the left-hand of the two, which has two smaller switches and an ammeter, and controls the plant lighting circuits. On the right are the four circuit panels, each fitted with an ammeter, a Wurts lightning arrester with its choking coil behind a circuit-breaker, a two-way switch—allowance being made for the possible employment of boosters subsequently—when the top contacts will include the booster in the circuit and the bottom contacts will connect the dynamo straight to the bus-bars—and a Thomson recording wattmeter. The Dorman & Smith circuit-breakers are of interesting design, shown in Fig. 10, in front and side elevation, the right-hand drawing showing a side elevation of the right-hand part of the device only. A tongue holds the laminated brush in position in its contact against the force of a spring so long as the handle on the right is in its upright position and its roller is pressing against the intermediate brass piece. The main current, however, passes through the bare copper coil on the extreme

right at the lower corner, and when this gets too strong it attracts the small piece of iron over it and pulls over the lever to its unstable position, from which it falls, allowing the other two parts also to fall back and break contact. The dial voltmeters and ammeters are of Weston make, and the recording ammeters are of Elliott Brothers' standard pattern.

The existing engine room measures 120 ft. x 60 ft. x 18 ft. high; and the new one, of which the walls and roof are already finished, is

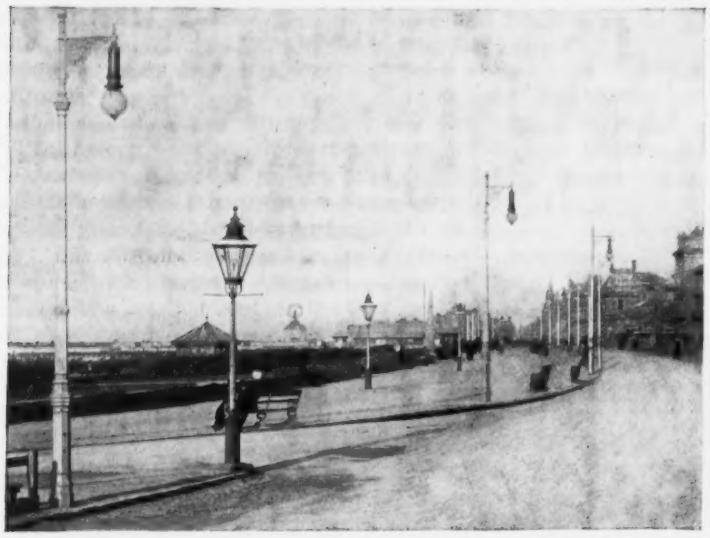


FIG. 5.—ARC LAMPS ON PROMENADE.

FIG. 6.—DOUBLE POLE CONSTRUCTION.

20 ft. wider and considerably higher, its dimensions being 94 ft. x 80 ft. x 25 ft. high, the heights in the two cases being given as the distance between the underside of the traveler and the floor. The boiler house has been extended a corresponding amount. Six boilers are in use at present, all of the Lancashire type, with the dimensions 28 ft. x 7ft., and by various makers. They are hand-fired. In the new boiler house Musgrave & Sons are putting in three Lancashire boilers 30 ft. x 8 ft. 6 ins., rated at 600 horse-power aggregate, all fitted with Musgrave superheaters to give 120 degs. of superheat. A Roberts 360-tube economizer is to be added to the existing 288-tube one of the same make. The scrapers are driven by a Langdon-Davies motor. A railway siding has been put down next to the boiler houses, so that the coal can be discharged directly from the trucks into the coal bunkers, the boiler room floor being below ground level and the tops of the boilers on a level with the engine room floor. The original ring steam main has given place to a single range of pipes. As already mentioned, the vertical Musgrave engine has its own jet condensers. In addition, there are Körting and Browett-Lindley condensers for the other sets. There is a large cooling pond in front behind the works, and water is pumped from a brook in the vicinity. Near to the generating station a spacious car shed is being built. The building will be of brick with timber ends, and will contain three bays, one of which will be walled off for a repairing shop.

The feeders of the trolley service are laid solid on the Callender

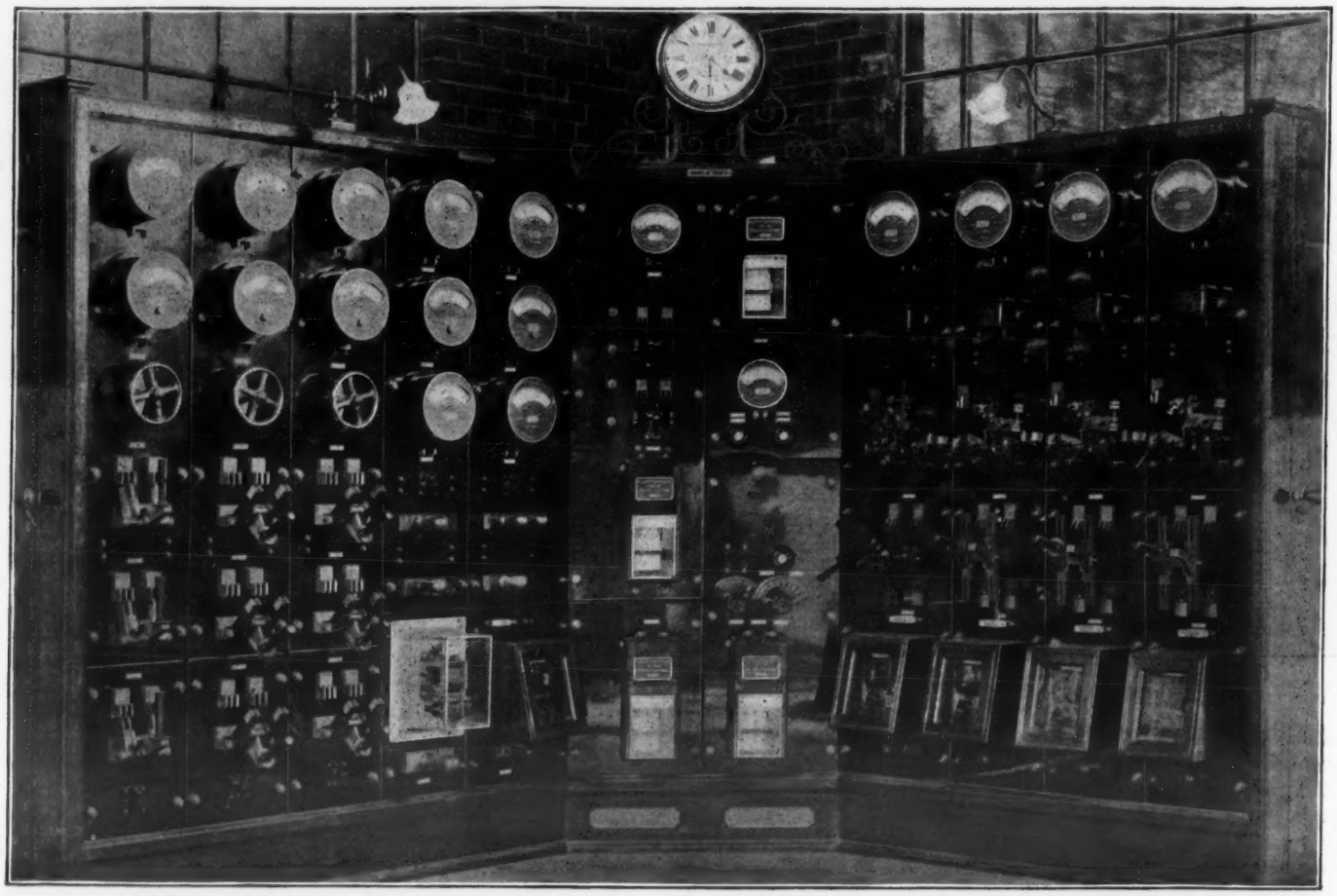


FIG. 7.—STREET RAILWAY SWITCHBOARD, SOUTHPORT.

system in semi-circular stoneware troughs. The lengths of trough have sockets, and as the cross-section is larger in reality than a semi-circle the pipe line is locked, so that adjacent lengths cannot sink unevenly. Compound is used to fill the space in the sockets. After the cables have been drawn in, and the whole pipe filled with compound,

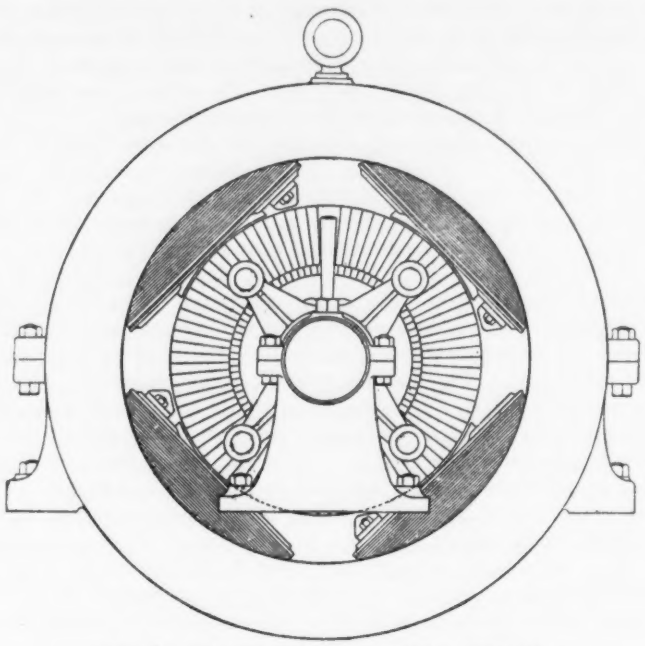


FIG. 8.—200-KW COMPOUND-WOUND DYNAMO.

the duct is covered with stoneware brick. Single bracket poles are used in part of the line construction, Fig. 4, holding the two wires, but there are also double lines of poles, Fig. 6, one each side of the street individually, for its own track, and not with span wires, as is usual in this country. The trolley wires are 00 B. & S. gauge. The line is divided into half-mile sections.

The contractors for the rails and permanent way were Dick, Kerr & Co., and some 800 tons of steel girder rails have been employed. These rails weigh 87 lbs. to the yard, are made up in 40-ft. lengths, and are jointed with "Dicker" joint and 0000 "Neptune" bonds. Cross-bonding is done every 120 ft. The gauge is standard, 4 ft.

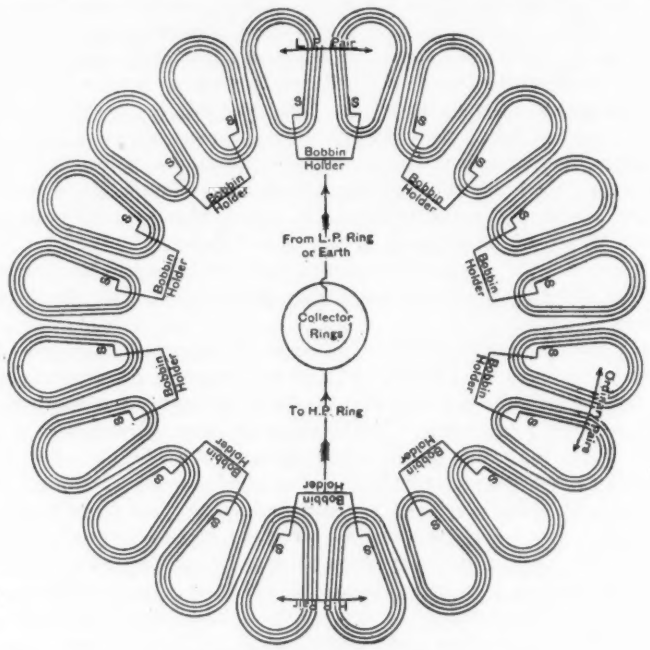


FIG. 9.—FERRANTI COPPER ARMATURE.

8½ ins. The rolling stock consists of nine double-decked cars and six single-decked cars, Dick, Kerr & Co. supplying both types. The cars have been manufactured at the Electric Railway & Tramway Carriage Works at Preston, and are of the reversed stairway type which, while affording complete protection to the passengers from the danger of falling off when ascending and descending the stairways, also furnishes an increased seating capacity of something like 12 per cent. The cars are of handsome appearance. They are mounted on Brill 21 E single trucks and are lighted electrically, having eight lamps in the interior and also headlights and platform lamps. The electrical equipments

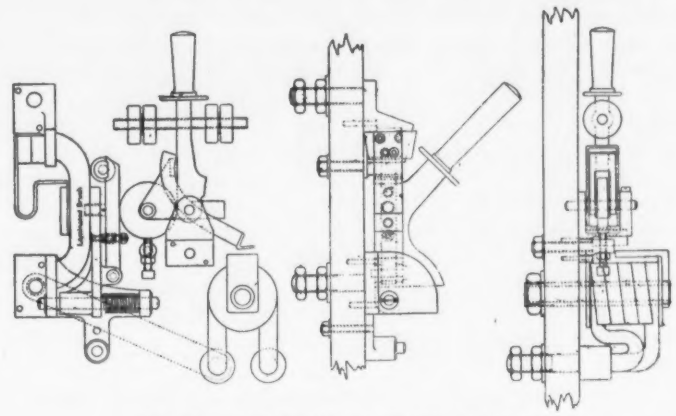


FIG. 10.—ELEVATIONS OF CIRCUIT BREAKER.

were designed by Prof. S. H. Short, and are of American type. They are, however, only to be left on the cars temporarily, and will soon be replaced by motors of a new design of Prof. Short's, which will be manufactured at the new works of the English Manufacturing Company. Two 25-hp motors are fitted to each car and the controllers are of the solenoid blow-out pattern. Each car carries 22 passengers inside and 34 outside. The six single-deck cars on order are combination open and enclosed cars seating 16 passengers inside and 16 outside. As there are no grades of any importance on the routes, ordinary hand ratchet brakes have been used, fitted with a short-circuiting brake for emergencies. Mr. C. D. Taite is the borough electrical engineer.

Electrical Possibilities of the Far East—III.

KOREA.

BY DR. PHILIP JAISOHN.

KOREA is the third important country in the Far East which possesses many promising features for the development of electrical industries. Fifteen years ago she was unknown to the majority of American people, and even now she is a terra incognita to many, yet since last summer the main street of the capital city of the empire has been traversed by an elctric railway built by an American engineer, and the cars are now run by American motormen. Situated as she is between three great empires, she has been the stage for her neighbors' political struggles and the bone of international contentions for many years. With these unfortunate foreign complications and her numerous palace intrigues and factional strifes in the Government, she has not only been unable to make any progress in her industrial or commercial enterprises, but in many cases has often been compelled to abandon what little improvement she made during the brief periods of freedom from these discouraging influences. Some years ago a paper mill was started near Seoul, the capital of the country, with modern equipments, but it was abandoned owing to a factional opposition and perhaps to some foreign interferences. A completely equipped electric light plant was purchased from the United States by the Government in 1894. It was erected in the Emperor's palace and was managed by two American engineers. But this enterprise came to an end at the time of the Japan-China war, during which the palace often became the scene of struggle between the combatting armies.

In spite of all these unfortunate circumstances under which the country has been placed, she has made some advancement in certain industrial lines. The Seoul electric railway is one of the crowning evidences of the willingness of Korea to adopt Western civilization, and may prove to be the precursor of many such enterprises in that empire under the direction of American engineers, equipped with American machinery. This electric road extends about 7 miles, beginning from the terminus of the Seoul-Chemulpo Railway to the tomb of the Empress. It passes through the busiest part of the city, traversing the entire length of the principal street. It is reported that the earnings of this road during the last year have exceeded the expectations of the promoters, and the outlook is even more promising

than before. The same company has projected several new lines to the suburban towns along the bank of the Han River and some are now in course of construction. The original capitalization of the company was $300,000, but it has been increased to $500,000, half of which is said to have been paid by the native subscribers.

The Korean Government owns and operates about a thousand miles of telegraph lines, and the Japanese Government maintains a military line from Seoul to Fusan, whence it connects the submarine cable to Nagasaki. The Korean Government line to Wonsan and north connects with the Siberian lines of the Russian Government, and the western line connects the Chinese lines at Yalu River. All the provincial capitals are connected by telegraph with Seoul and Chemulpo, the principal port of the country, thus bringing them into speaking relations with all parts of the world. The Korean telegraph service is managed by a Danish expert who was formerly in the employ of the Great Northern Telegraph Company. Under his able management the Korean telegraphic service is rapidly improving, and the native operators are getting quite familiar with foreign languages. Messages can be sent either in Korean or Chinese, or in Roman letters.

Within the last few years the telephone has become quite popular in Korea. Even the most conservative statesmen take delight in talking to their friends through a telephone. The Emperor's palace is connected with the different Government departments by telephone, and some of the police stations in the capital have direct telephonic connections with the main department. According to a recent report an American company is going to establish a commercial telephone system in Seoul and Chemulpo, and the same company is thinking of starting an electric light plant in the latter place. Judging from the estimates given by competent electrical engineers as to the cost of establishing these industries and the probable revenue from them, both enterprises will bring handsome returns after a few years' operation.

Korea has an area of about 100,000 square miles, with a population of 12,000,000. The soil is fertile and the climate excellent. According to a European observer only 23 per cent of arable land is under cultivation. Agriculture is her principal industry. Rice, wheat, beans and barley are raised, considerable quantities of which find ready markets in Japan, China and Siberia. Ginseng is another Korean product which may be considered an important article in her export trade. Under a proper government and judicious introduction of foreign machinery and methods, her agricultural interests may be vastly improved, thus creating wealth and prosperity among the tillers of the soil, who constitute a large and important class of the population. But the real great wealth of the country is in her unexplored and undeveloped mines of coal, gold, etc. The abundance of both anthracite and bituminous coal mines in Korea will facilitate materially the development of electrical enterprises, but the most economical way of establishing such industries there will be the utilization of the numerous streams which abound in that peninsula.

Pyengyang is the capital of Southern Pyengando and is the metropolis of the Northwest. This is one of the oldest cities in Korea and is rich in historical associations. It has a population of about 100,000 and is growing quite rapidly since its opening to foreign trade by the Taidong River. There are several foreign residents, among whom are a dozen or so American missionaries. Its proximity to Chinnampo and many large interior towns above the river makes it specially important as a trade centre of distribution and collection for that part of the peninsula. There are several coal mines near the city which produce a very fine grade of anthracite. Some enterprising Koreans have recently formulated a scheme to build a railroad between Pyengyang and Chinnampo, but owing to the lack of capital and the stringency of the money market they have not made much progress. An electric railway between the two cities, utilizing the water power of some of the tributaries of the Taidong, can be built much more economically than a steam railway, and at the same time it will answer all present requirements. It is possible that the American company which built and operates the electric road in Seoul may make arrangements to build this line, as such an enterprise will surely bring profitable returns.

Whanghaido, or the Yellow Sea Province, is the least populated of the provinces. Its coast line exceeds its land frontiers. It juts out into the Yellow Sea, forming a peninsula, the extreme point of which lies nearest to Shantung Promontory in China. The chief industry of this province is fishing, and its coast is rich in pearls of brilliant lustre and great size. Kyengki, or the capital province, is smaller in area than any other, but politically and commercially is the most important of all the provinces. Seoul, the capital, and Chemulpo, the principal port of the empire, are situated in this province. Seoul has a population of about 200,000, with fairly good streets. The city proper is about three miles from the Han River, but there are many towns along the river bank, which are really the suburbs of Seoul. Within this city are the royal palaces, various government offices, foreign legations and consulates, and some 3000 foreign residents, among whom the Japanese outnumber all other nationalities combined. The streets are now lighted by oil lamps, but electricity will, more than likely, take the place of kerosene before many years. A sufficient account has already been given regarding the Seoul electric railway.

There are many rapids and waterfalls on the Han River, a few miles above Seoul. The natural scenery along the rapids is magnificent and the surrounding mountains and valleys are most picturesque. Many of these powerful waterfalls will furnish almost unlimited power for practical use if they are so utilized.

Chemulpo is 27 miles by land, and 40 by river, from Seoul. They are now connected by a railway, the concession of building which was originally given to an American company, but owing to financial reasons the American concessionaire sold the road to a Japanese syndicate before it was quite completed. The locomotives and rails used on this road were imported from the United States, while the cars were made in Japan, except the wheels, which are also of American manufacture. The construction of the bridge across the Han River is not quite finished, but will be during this summer. The structural iron and steel used in this bridge were furnished by an American manufacturer.

Fifteen years ago Chemulpo was a mere hamlet, inhabited by a few Korean fishermen, but since its opening to foreign trade it has grown to be a most flourishing little city. It has already a population of about 20,000, and is constantly growing, in both the foreign and native settlements. It has several rice cleaning mills, some of which are owned and operated by Americans. It has branch offices of two European and three Japanese banks, and it possesses fairly good shipping facilities. There is, as yet, no electrical industry of any kind in this port, but, if the recent advice be true, it will have electric lights and telephones before the year is out.

Kangwon, or the River Meadow, and Hamkyeng, or the North and South Complete Views, are three Northwestern provinces. There is no city of any magnitude in the former, but it is noted for natural scenery and numerous forests. In Hamkyeng Province there are a number of important places. The ports of Wonsan and Kyengsung have been opened to foreign trade and both are growing to be thriving towns. In the former port Japanese interests predominate, while in the latter Russians control the trade. The province is noted for rich bituminous coal deposits, but none of them have as yet been properly developed. A Russian company obtained, a few years ago, a concession to work coal mines near the Russo-Korean border line, but it has not yet taken any steps for active operation. There was talk of erecting an electric light plant in Wonsan by a Japanese company, but nothing more has been heard since. If the Korean company which projects a railroad from Pyengyang to Wonsan via Seoul should succeed in carrying out its plans, there will be a great change in the industrial and commercial development in this part of Korea.

There are six southern provinces, but nothing specially electrical can be said about them, although they present many excellent opportunities.

On the whole, Korea has made some advancement in spite of her corrupt and unstable government, and the numerous foreign complications in which she has been thrown since the opening of the country to the world's commerce. The Koreans are naturally hospitable, and their ideas are much broader than those of the Chinese. Since the conclusion of commercial treaties with foreign nations, no European or American has ever been violently treated in Korea, nor has their property ever been attacked by the natives. They entertain no dislike for foreigners and seem to be willing to learn Western civilization. If they are only governed properly by educated officials who have the welfare of the country and its people at heart, they will soon improve, both in intellect and material wealth. However, one thing is certain, and that is the country will not retrograde under any circumstances. She may be permitted by foreign powers to exist as an independent State, or she may be placed under the protection of one of her neighbors. In either case the education of the people will improve and the commerce and industry of the country will develop. Korea is not so advanced as Japan and not so immense as China, but she has many attractive features of her own which make her an important market for our electrical machinery, an inviting field for our electrical engineers, and a profitable soil for our investors.

Systems and Apparatus for Light and Power Distribution—II.

(Concluded.)

By C. P. Steinmetz.

In the converter the actual armature current is the difference between alternating and continuous current, and the armature reactions neutralize, thus a very small conductor section is used to secure best commutation, and very high nominal armature reaction to secure high output and stability. A double current generator used as a converter is more liable to hunting, and a converter as double current generator to sparking and heating. It is essential for the efficiency and reliability of operation of such a system, to choose the simplest possible arrangement, and the least number of transformations of power. Wherever, therefore, the sub-station can be reached with 6000 or 10,000 volts, a direct generation of the transmission voltage is preferable to the use of the step-up transformers. The 6000 or 10,000-volt generator is just as reliable and efficient as a low voltage machine.

One important feature to be considered in the design of the generating station is, nowhere to bring the total power, or even a very large part of it, close together. Thus the cables leading from the generators to the bus-bars, and the feeders issuing from the bus-bars, should be separated in a number of different conduits as far apart from each other as possible. We must consider that at the voltages and powers existing in such stations a short circuit in a cable is liable to destroy, or short circuit any cable within 10 ft. distance, or more. In a lesser degree the same applies to the sub-station. The high-voltage conductors, bus-bars, etc., should preferably be kept away from the operating switchboard altogether, the instruments supplied by transformers and all switches operated by relays, to secure safety to life. A further important feature, in stations where the power is transmitted by cables, is the protection against excessive rise of voltage as caused by resonance phenomena in making and breaking circuit, etc., the more as insufficient protection of the cable usually does not make itself felt immediately, but shows as a rapid deterioration of the cable, breakdowns beginning to occur after some months, and then appearing with increasing frequency.

Where overhead lines and cables are used in the same system, lightning protection must be provided wherever a cable joins an overhead line, and every such place constitutes a weak point of the system.

In the consumer's circuits the power is used: (A) As continuous-current three-wire system with about 250 volts between the outside conductors, for the central part of the distribution; (B) As alternating current for outlying districts and pioneer work; (C) As constant current, either continuous or alternating, for series arc lighting.

(A) To change the three-phase power received from the generating station to 250-volt, constant potential, continuous current, the rotary converter is the most suitable apparatus. It requires step-down transformers. In the chain: generator, transmission line, transformer, converter, the transformer is the weakest link regarding overload capacity, since at overloads the temperature of the transformer rises at a much faster rate than in the converter or the generator. In all these apparatus the losses consist of two parts—a constant loss, practically independent of the load, as hysteresis, friction, shunt field excitation, and a loss increasing with the square of the load: I^2R in the main conductors and brushes. Obviously where the latter loss is small and the main conductors so imbedded in the iron as to transfer their heat rapidly thereto, as in the converter, and to a somewhat lesser extent in the generator, the temperature rises quite slowly with the load, being rather proportional to the total loss in the apparatus. In the transformer, however, the conductors must of necessity be massed together and separated from the iron, so that the temperature of the coil is more independent of that of the iron. That means that at double load, where the loss in the conductor is four times as large, the temperature rise will be very much greater than in the converter for instance, where, at double load, the temperature rise may be increased only 50 per cent, or even less. Since in emergencies an overloading may not always be avoidable, especially in a system where the first consideration is to maintain the service under all conditions, it appears to me advisable to select the transformer capacity very liberally. For the same reason I prefer air-blast transformers for this class of work, since the air as expansive fluid reaches everywhere, and therefore the liability to local heating is small, while with oil as cooling medium, due to the sluggishness of the oil stream, pockets may be formed in which the oil does not properly circulate and a destructive local rise of temperature is liable to occur. It is desirable to give each converter unit a separate bank of transformers, since when operating several converters from the same transformers, a pulsating cross-current flows between them, if the position of the brushes is not very carefully adjusted, and causes sparking and heating.

The simplest, and thus the most reliable arrangement, is to consider the converter and its transformers as one piece of apparatus, put in and out of service together, and connect converter and transformers permanently together on the low potential side by conductors of the least possible length. With the heavy low voltage alternating currents in these conductors, self-induction and mutual induction easily become formidable with any greater lengths of conductors. The only case where the possibility of transferring any converter to any transformer would be of advantage is, if one converter and a transformer of another converter are disabled simultaneously. It appears to me by far preferable, however, in this rather improbable case to heavily overload the remaining units than to go to the excessive complication inherent in a transfer device.

The converter unit can consist either of two machines of 125 volts, connected between neutral and outside conductors on the three-wire system, or of one 250-volt machine. The former has the disadvantage to commutate the current twice, but the advantage to establish and maintain the neutral. It is usual in continuous-current generating stations, where face commutator machines are used, since this type of machine lends itself best to 125-volt construction.

For the rotary converter, however, 250 volts is far preferable to 125 volts, since it requires to commutate only half as much current, and gives a better machine regarding commutation, efficiency, etc. Thus 250-volt converters are preferable, and are more economical also regarding space.

In case of their use, the neutral can be fed: (a) From a pair of 125-volt machines or an equalizer set; that is, two 125-volt machines on the same shaft, connected in series across the circuit. (b) From the storage battery where used. In either of these cases the voltages of the two sides of the system are independent of each other; that is, can be made unequal if desired. (c) From a pair of alternating compensators connected to a rotary converter. In this case the two voltages are necessarily equal, and thus to produce a difference, a booster is required in the neutral, which may be driven by the converter. (d) A continuous-current converter. This is a 250-volt commutating machine, connected across the outside mains, but supplied with two pairs of collector rings connected with equidistant points of the armature. Two compensators, or auto-transformers, are connected between these collector rings and joined with their common centre to the neutral. Here the two voltages are equal also, and thus a booster desirable, which may be driven by the continuous-current converter. The continuous-current converter in some features, as the absence of armature reaction, the increased output, etc., shows a similarity with the synchronous rotary converter, except the synchronous feature is absent.

The disadvantage of case "a" is that two 125-volt machines must always be maintained in operation. The disadvantage of "b" is that with any noticeable unbalancing of the system the two halves of storage battery are charged and discharged unequally. The disadvantage of "c" is that always at least one converter with compensator and booster must be maintained in operation. The disadvantage of "d" is the use of an additional machine. Thus which arrangement is chosen depends rather on the conditions of the individual case. Since with the change of load the bus-bar voltage of the sub-station is varied, the voltage on the converter commutator must be varied, by varying the alternating impressed voltage. This can be done either by varying the ratio of transformation of the step-down transformers, or by the insertion of potential regulators. The ratio of transformation of the step-down transformers is varied by cutting out primary turns by a dial switch attached to the transformer. This arrangement necessarily is a step-by-step method, but sufficiently close for almost all purposes, except perhaps for slightly shifting the load from one converter to another. It has, however, the disadvantages that, when the converter voltage is high, a part of the transformer winding is unused. The potential regulator, of the induction type, consists of a three-phase transformer with movable secondary, the primary being connected in shunt, the secondary in series to the circuit. By the motion of the secondary the phase relation of the secondary voltage is varied so as to change from additive to subtractive. The induction regulator gives a perfectly gradual variation of voltage and has the

great advantage of affording, by its self-induction, a flexible connection between converter and generator. This is very desirable.

In a converter or synchronous motor circuit, we have two independent e. m. f.s, that of the generator and that of the converter, connected in parallel, and thus if these e. m. f.s are not exactly corresponding to each other, a cross-current flows between the two machines, which is limited only by the self-induction of the circuit. Thus self-induction is necessary and essential in a synchronous motor or converter circuit. Step-down transformers and converter armature offer some self-induction, which with proper care and control of the field excitation may be sufficient, but the reliability of operation is greatly increased by the insertion of an additional self-induction, as that afforded by the induction regulator. The induction regulator, however, is considerably more expensive than the step-by-step control of the dial transformer.

A storage battery may be used in the converter sub-station with the same advantage as in a continuous-current generating station. Since the storage battery must be able to discharge at the highest voltage required in the system, and the charging voltage is from 20 to 25 per cent above the discharge voltage, it follows that, if the storage battery shall be charged directly from the converter, an additional margin of voltage of 25 per cent must be provided in the latter. This is extremely undesirable, since it brings the range of voltage variation outside of that which conveniently can be covered by an induction regulator, requires the converters and transformers to be 25 per cent larger, and, what is the most important feature, requires such changes in the constants of the converter, which make it in every way a less desirable machine, especially regarding hunting and efficiency. That is, a converter intended to operate anywhere between 220 and 320 volts cannot be made as good and reliable a machine as one intended to cover only the range from 220 to 270 volts, for instance. Therefore, it is preferable to charge the battery through a series booster, which may be driven by the converter. In this case, however, the booster may also be used in the discharge of the battery, the end cells and the trouble and complications caused by them entirely avoided. The preferable way of installing the storage battery appears to be connect permanently in series as many cells as give the mean bus-bar voltage at open circuit, and connect it to the system through a series booster. In charging, the series booster adds to the station voltage the increase required to give the charging voltage. In discharging it adds to the battery voltage the amount required to bring it up to the bus-bar voltage. In either case the booster is generator.

(B) The second class of work done by a sub-station is alternating-current supply to outlying districts. While in some places alternating supply will always remain preferable, in others the ultimate development is toward continuous current, by small transformers supplying individual customers, larger transformers on secondary circuits supplying several adjacent customers, a secondary network with large transformers, a system of three-wire mains, first fed by large transformers, then by feeders from a converter sub-station with continuous current. The preferable alternating system thus is one permitting the operation of a three-wire system; that is, either a single-phase system or a quarter-phase system with common return. The unbalancing inherent in the latter is usually not objectionable, since long before the drop in the mains becomes serious, the change to continuous current occurs.

Where the frequency of the generating station is 60 cycles, step-down transformers are all that is required, changing from three-phase to quarter-phase, where the current exists. Otherwise either a four-wire, three-phase distribution, or a system of three-wire, single-phase lighting with three-phase power is preferable as simpler and more efficient.

With 25-cycle generation, motor generators or frequency converters are needed. With motor generators, per 1-kw output, 2 kilowatts of machinery are required, with frequency converters only 1 kilowatt, of which a part, however, is of a more expensive type. In the latter case, just as in the rotary converter, the secondary voltage is proportional to the primary, so that, to vary the voltage, potential regulators are needed. Obviously the frequency converter when changing from 25 to 62.5 cycles, for instance, at the same time can convert from three-phase to quarter-phase or single-phase. An induction regulator in the primary controls the whole system, or individual secondary feeders are controlled by separate potential regulators, preferably of the magneto type.

(C) For series arc lighting either constant alternating or constant continuous current can be used. With the 60-cycle generating system, alternating arc lighting supplied by constant current transformer or equivalent apparatus is decidedly preferable in simplicity and efficiency.

With a 25-cycle generating station series arc lighting can be done: (1) From arc machines driven by synchronous or induction motors. This arrangement has the advantage to require power and current only proportional to the load, but since the number of arcs which can be carried by one machine is limited in large stations, a considerable number of machines are needed, and the space economy of the arrangement is rather low. (2) Constant current transformers and rectifiers may be used. This arrangement is somewhat more efficient, but the light load and even full load power factor is low. At no load just as much current is required as at full load, and the arrangement is thus undesirable wherever the circuits cannot be operated always at fair load. Like in the first case, a considerable number of individual apparatus are required, which, however, take less space. (3) The series arc lighting can be put on the alternating system, that is, the frequency converter or motor generator, and operated by constant current transformers. With the enclosed arc lamp the alternating arc lighting has become very satisfactory. The objections are the low power factor and apparent efficiency at light load. (4) Series arc lighting can be done by alternating current from a special motor-driven constant current alternator. The advantage of using an alternating arc machine is that, instead of many smaller machines, one large machine unit can be used, feeding a number of arc light circuits over series transformers. In this case also arc circuits of different voltage and different current can be operated from the same machine. In this system low voltage indoor illumination can be provided by operating in series with transformers feeding high voltage circuits of many lamps, other transformers feeding only one or a few lamps at safe potential. By using separate constant current alternating machines of large capacity, the objection to the low power factor of alternating arc lighting disappears, and a higher frequency can be chosen, which has some advantages for arc lighting.

American Cables for the Philippines.

None but those who have occasion to watch closely such developments are aware of the scope and importance of recent land line and cable work in the Philippines, under American rule. Lieut. Col. James Allen, chief signal officer in the Philippines, in submitting his report of the operations of the United States Signal Corps, states that he has under him 350 men available for duty and 3000 miles of telegraph lines and cables. During one month 208,085 messages were sent and received on the Island of Luzon, besides a large amount of business transacted exclusively by telephone.

The most notable feature lately is the increased amount of line cutting, which kept many men employed in repair work. On the Island of Panay communication in the eastern portion of the island has been abandoned, but it is expected the line will be rebuilt. Twenty miles on the west coast have been destroyed. On Leyte much of the wire put up has been torn down. Many encounters with the insurgents resulted seriously and linemen are often picked off by Filipinos.

It is in view of these conditions and others now arising that the United States Government has determined to carry out a most extensive system of telegraphic and telephonic communication, bringing every important point in the group into immediate touch. This work was planned originally in connection with the steamer "Hooker," which, carrying out a large consignment of wire and cable, was wrecked off Corregidor Island. One result of the unfortunate delay was that larger plans were adopted, and last week the United States cable steamer "Burnside" sailed from New York for Manila, via Suez Canal, with some 600 miles of cable on board. The "Burnside" has not been temporarily adapted to her purposes, but has been so thoroughly transformed for her new uses that she will practically never be fit for any other service. She has three tanks full of cable, and at Manila the steamer "Romulus" will deliver to her all the cable-laying machinery which she does not take out herself. The expedition is headed by Capt. G. O. Squier, United States Signal Service, who has come forward quite prominently of late in cable work and invention, and has recently been on special detail as to the Pacific Cable. With him are Mr. Henry Winter, as cable engineer, and Mr. F. A. Hamilton as electrician. The inspection of the cable was conducted most carefully by Capt. S. Reber, U. S. A., Dr. A. E. Kennelly and Mr. Townsend Wolcott, on behalf of the Government, at the respective factories. The expedition is the most important engaged in by our Government, and in well-informed circles is regarded

MAP OF THE

PHILIPPINE ISLANDS

SHOWING

Signal Corps Telegraph Lines and Cables.

EXPLANATION:

Military Telegraph Lines

Military Cables

Projected Cables

Projected Military Telegraph

Cables, Contemplated

British Cables

SCALE OF MILES

0 50 100 150 200

Longitude East from Greenwich

115° 120° 125°

20° 15° 10° 5°

CHINA SEA

PACIFIC OCEAN

Canton

Hongkong

FORMOSA

Cable Manila to Hongkong

Manila Bay

Laoag

Aparri

Vigan

Lal-lo

Amulung

Tuguegabao

Cabagan

Ilagan

Camarag

Bolinao

Dagupan

Bimalunan

S. Nicolas

Carranglan

Sumacap

Magalang

Iba

Bulacan

Pasig

MANILA

POLILLO I.

Mariveles

Lumbang

Majayjay

Antipolo

Taytay

Daet

Batangas

LUBAN I.

CATANDUANES I.

Caceres

Minalabag

Pasacao

Albay

MARINDUQUE I.

Sorsogon

BURIAS I.

MINDORO I.

MINDORO STRAIT

TABLAS I.

SIBUYAN I.

MASBATE I.

SAMAR I.

Catbalogan

BUSUANGA I.

CALAMIAN I.

LINACAPAN I

PANAY I.

Panay

Concepcion

Ormoc

LEYTE I.

S. Jose

Iloilo

Bacolot

Manapla

Cebu

Talisay

DUMARAN I

PALAWAN ISLAND

NEGROS I.

Sulu Sea

Tanon Strait

DINIGAT I.

SURIGAO I.

Canayan

BOHOL I.

Tagbilaran

Bais Bay

Dumaguete

P. Bombonon

Dapitan

Cagayan

Misamis

Iligan

MINDANAO

Tigumna

Pto Pollok

Cottabato

Zamboanga

BASILAN I.

SULU I.

Pulangi R.

BALABAC I.

BALABAC STRAIT

BANGUEY I.

NORTH BORNEO

CELEBES SEA

not only as an imperative measure for the maintenance of quiet and order in the Philippines, but as a first step in the American Pacific cable work between the Pacific Slope and Asia.

The deep sea cable taken consists of a conductor of seven No. 24 B. & S. wires of 98 per cent conductivity, with an insulating layer of pure para 1-64 in., and a layer of compound not less than 40 per cent para, bringing the diameter up to 8-32 in.; then a layer of best rubber cloth tape, double lap. This core is served with two layers of best Calcutta tarred jute, in reverse directions, and an armor of sixteen No. 12 B. & S. galvanized steel wire with not more than 10-in. lay. The outside finish is hot asphalt compound, a layer of Calcutta jute, hot asphalt, another jute layer in reverse, and hot asphalt.

The shore ends are the same as the deep sea, except for additional armor over the first of sixteen No. 6 B. & S. galvanized steel wire, with the same outside finish. The core insulation was tested with 5000 volts alternating current for 5 minutes, submerged in water. The finished cable was tested with 1000 volts alternating for one minute between the core and the armor. After 24 hours' immersion the insulation had to measure at least 1000 megohms per mile at 60 degs. F. The copper resistance at 60 degs. F. was not to exceed 18.63 ohms per mile.

The steamer when she left had a complete testing room in a separate deck house, fully equipped, with the piping for cable ready, and with all necessary supplies and stores for laying and repair. The expedition carried also several sets of wireless telegraph apparatus of the type specially designed by the United States Signal Corps. We publish herewith a map kindly furnished us, which gives a number of interesting details as to the cables, land lines, heliograph sections, etc. It will be noted that the whole group is connected from Laoag and Aparri away up north to the Island of Sulu, in the extreme south. The network of land lines is thickest in Luzon, Panay and Mindanao, and when the new military cables "projected" and "contemplated" are down, all parts will not only be in direct communication with each other, but with the existing cable from Manila to Hongkong. This work the new expedition is under instructions to carry out with the utmost dispatch, and it is believed that a new record may be made in this respect, no effort having been spared in securing an efficient staff, adequate equipment, a commodious ship and good cable.

A Suburban Overhead Double Trolley, Washington, D. C.

One of the most interesting pieces of trolley track laid of late in the United States is that which is herewith illustrated. Its special peculiarity is that, so far as is known, it is the only section of double

FIG. I.—DOUBLE TROLLEY, SIDE POLE.

trolley construction that has been put up for some time in this country, and that instead of being required for the crowded part of a city it is located in a distinctly rural or suburban region.

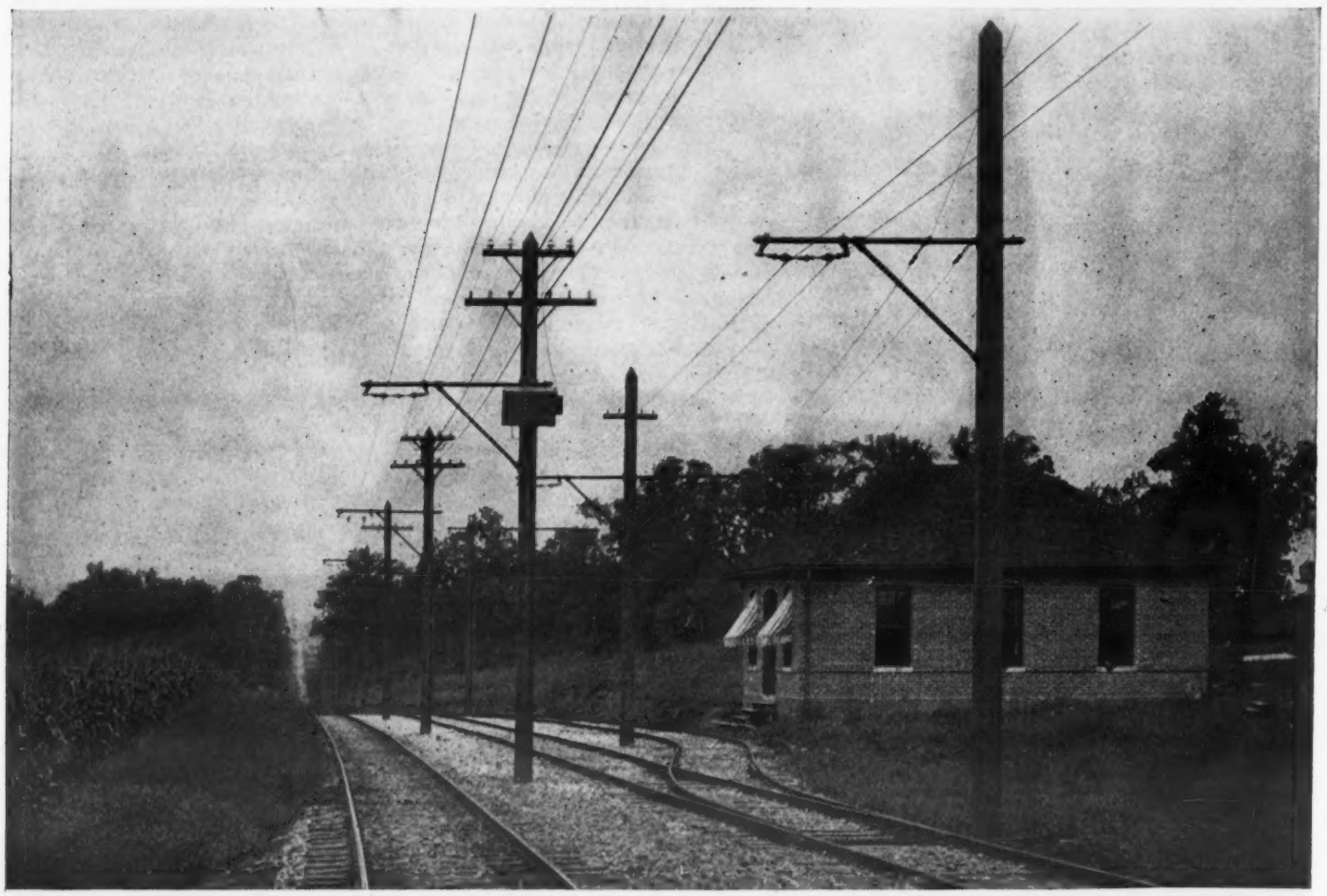


FIG. 2.—CENTRE AND SIDE POLE DOUBLE TROLLEY CONSTRUCTION, WASHINGTON, D. C.

The stretch of track illustrated is on the line of the Washington Traction & Electric Company, which controls nearly all the street railways at the national capital. The particular portion under notice is a suburban line running to Rockville, Md., which is about 16 miles from the U. S. Treasury Building on Pennsylvania Avenue. The road is a reconstruction and extension of the old Georgetown & Tenallytown road. It is laid with 70-lb. T-rail, in 30-foot lengths, Weber joints, and is, it should be specially noted, bonded with protected rail bonds. The District authorities required a double trolley system, *i. e.*, without rail return, and, as will be seen, the work has been done in accordance with the requirements of such an unusual character—requirements that may even be described as surprising in view of the nature of the locality; but the track has been bonded, nevertheless. The ties are 6 ins x 8 ins. x 8 ft. of Georgia pine, and the road is ballasted with broken stone extending from 4 ins. under the ties to the tops of the ties. The poles are 35-ft. octagon Georgia pine, 10-in. tops and 12-in. butts set in concrete. The trolley wire is No. 00 round wire, held by 15-in. ears, hammered over. The trolley hangers, which are all special, are of Macallen make. The poles carry a high-tension transmission line, which is reduced to 500-volt direct current at a rotary sub-station. The track is laid out with easy curves, and although some of the gradients are very heavy, as the cuts indicate, very high speed is made. The culvert foundations are all made of concrete.

This line, built by J. G. White & Company, of New York, is double-track, centre-pole construction for about four miles, this portion being known as the Georgetown & Tenallytown Electric Railway. The remainder of the line to Rockville, about 12 miles, is single-track, side-pole bracket construction, and is known as the Washington & Rockville Railroad. It is difficult to understand why single trolley and track return would not be entirely adequate for the conditions of safety required by park land and cornfield, but the exactions of the authorities of the District of Columbia have certainly led to the construction of a very interesting and excellent bit of double-trolley work.

The Plant of the Woronoco Street Railway Company, Westfield, Mass.

The installation of storage batteries at the power house of the Woronoco Street Railway Company, in Westfield, Mass., presents features of special interest to companies operating small electric roads. After considering various methods of providing an increase of power-house capacity, rendered necessary by the construction of an extension of the line to connect through to Springfield and the consequent increase in the number of cars operated, it was decided that the storage battery offered advantages which could be secured in no other way and the results obtained by such installation have, it is said, fully justified this decision.

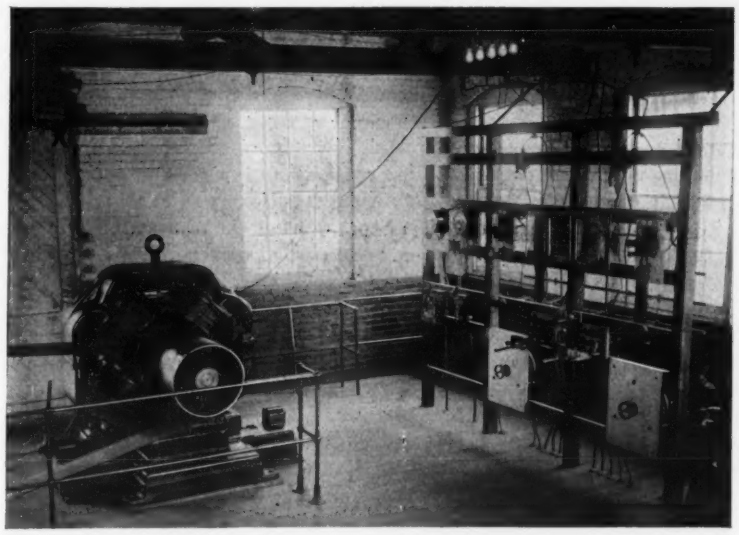


FIG. 1.—SWITCHBOARD.

The station equipment consists of two 75-kw multipolar generators belted to two 120-hp, high-speed, simple, non-condensing engines, steam being furnished by two 90-hp, return tubular boilers. Figs. 1 and 2 are views of the steam plant and switchboard.

The battery consists of 264 cells of the Chloride accumulator, Type F11, in glass jars of Type F13, permitting an increase of 20 per cent by the addition of one pair of plates in each cell; and is installed in a small brick extension to the power house. Fig. 3 shows the interior of the battery room, and the arrangement of the cells, these being located in one tier, each cell being supported on a sand tray resting on four glass insulators. The foundation for each row of cells consists of two stringers of wood suitably braced and supported on brick piers. The plates are of the Electric Storage Battery Company's

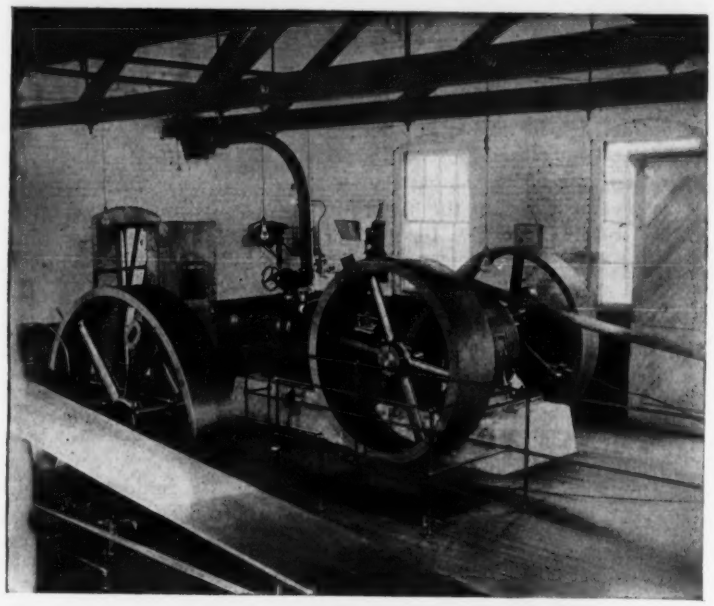


FIG. 2.—GENERATING PLANT.

standard type, and the elements in adjacent cells are connected by two lead straps, perfect joints being secured by lead burning with the hydrogen flame.

This is one of the few railway regulating batteries installed at the power house, where a battery booster has not been found absolutely necessary. It was understood that in order to dispense with the booster a certain portion of the fluctuations of load must fall on the generator, and a certain variation of voltage must be permitted at the bus-bars in order that the battery may take its proportion of the load. These conditions were not regarded as objectionable considering the character of the plant and the small drop in the feeders. The results obtained in regulating the load on the machines have proven very satisfactory.

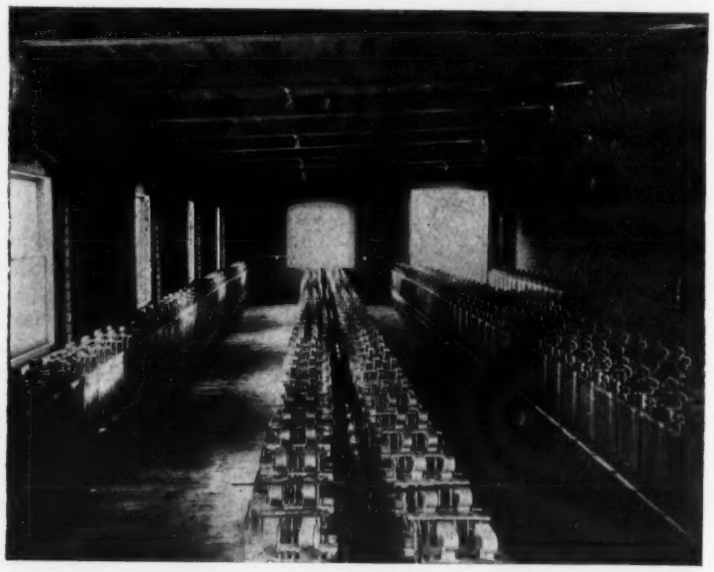


FIG. 3.—BATTERY ROOM.

The load diagram shows that by means of the battery the load on the machinery is reduced within the capacity of one unit, leaving the second one as a reserve in case of accident or an unusually heavy load, while the total load, without the battery, would fully tax the capacity of both machines. The effect on the economy of

operation, due to developing by means of one unit the output, which without the battery would require two, is clearly shown by the station records given in the subjoined table:

	Date, 1899.	Lbs. coal.	Output, kw-hrs.	Lbs. coal per kw-hr.
With battery.....	Oct. 25-27	16,250	3,032	5.36
Without battery.....	Oct. 28	6,250	981	6.37

This shows an increase in the coal consumption of 19 per cent on the day when the operation of the battery was discontinued. This plant is also noteworthy from the fact that the station attendance is reduced to one man per shift, the engineer doing his own firing. This arrangement could not have been continued under the conditions of increased load, had it not been for the improved regulation and reduction of coal-handling, and especially the increased reliability of operation secured by the battery.

On several occasions the battery has been called upon to carry the entire load of the system for an hour or so, doing a temporary shutdown of the rest of the plant, as well as early in the morning or late at night, when only one or two cars are in operation.

Pittsburg Meeting of the Municipal Electricians.

In the ELECTRICAL WORLD AND ENGINEER of last week details were given of the opening sessions of the annual meeting of the International Association of Municipal Electricians, and notes were made of many of the exhibits. Subjoined is the record of the later proceedings.

MORRIS W. MEAD.

The second day's session began at 9:30 a. m., when President Brophy read the paper by J. L. Morgan, of Kansas City. He stated that since he had received his invitation to participate, the office of city electrician had been abolished and "he was no more." As to the conditions under which an official did his work, he said: "The petty annoyances of a self-respecting engineer in such a position are wellnigh insufferable. The ethics of the profession demand that dignity should be omnipresent, but dignity and aldermen are strangers. All attempts to impress them are failures. In vain you tell of the thousands of dollars you have saved the city by the detection and elimination of electrolytic corrosion, or speak volubly of the important plans that you have under consideration. The alderman dismisses such propositions with a gesture, and you come down to earth with a jar when he tells you that he has a friend whose doorbell don't work, or that his current meter is 'working overtime and would like you to fix it up right.' If he don't want his doorbell fixed or his meter shunted, he probably wants a city telephone placed in his hall, or a city arc lamp in his parlor, or perhaps he only wants his gasoline stove repaired. When the influential member introduces you to his brother-in-law and confides to you that he is to be your chief and probably sole assistant, this with the confidence that he is a first-class kalsominer, and that 'in a few days he will learn to be a good electrician,' you will cheerfully accept this as an axiomatic proposition—never show the slightest annoyance. If you don't like him, take him out and connect him up with the alternating primaries. This is not crime, it is philanthrophy. In practice this has given the highest satisfaction. With the Council be diplomatic; if you can't be diplomatic, be as diplomatic as you can. Endorse unreservedly any and every proposition advanced by any member at any time or at any place."

Mr. D. R. Walker, chief of the Electrical Bureau, of Philadelphia, made a lengthy and interesting address on the work performed by his bureau, which he thought was the most comprehensive in the country.

Mr. M. W. Mead, of Pittsburg, Pa., read a paper on electrical connections, by Mr. Frank C. Mason, of Brooklyn, N. Y. Mr. Mason classed contacts into three groups: Permanent, such as those in wires and cables; semi-permanent, such as contacts between wire and binding post; and operative at will, such as keys, switches, etc. To all these there were two enemies—chemical action and dirt. A strong plea was made for good work in permanent joints and for the use of higher metals, such as platinum, in contact points.

A paper by Mr. M. G. Canfield, of Grand Rapids, Mich., was on the trials and troubles of instituting and enforcing municipal inspection and control. He instanced typical bad work and showed how hard it is to get people up to the latest safe standards in the art. As to maintaining high-grade construction, he said: "There is another matter that is worthy of considerable thought by municipal inspectors, and that is who shall and who shall not do electrical work on their own responsibility. It should not be the desire of any one to place obstacles in the way of a man to earn an honest dollar when he can; neither is it good policy to allow school boys and a floating element that is always with us (except when we want to find them) to do electrical construction. As a remedy for this evil I am very much in favor of making it necessary for a company or person doing electrical work to be licensed and give a bond of say $1000 to protect the license. There should be no fee attached to the license to make it a hardship for a competent man to earn a living, and there is no question but what any competent and respectable man could obtain two sureties on a bond to protect a license. If this policy is carried out much time will be saved by the inspector."

The discussion of Mr. Canfield's paper took up the entire morning session.

New members elected at the meeting were E. W. F. Betteridge, East Liverpool, Ohio; Joseph Rothgary, Cleveland, Ohio; H. B. Mason, Brooklyn, N. Y. James P. Barrett, Jr., Chicago, Ill. Clarence E. Stump and James M. Gardner, both of New York, were made life members of the association.

When the afternoon session was called to order Mr. F. P. Foster, of Corning, N. Y., read a paper on automatic fire alarm systems, prepared by Mr. Chas. Burger, of Boston, Mass. This paper was largely historical and recapitulatory. One new point mentioned was a method in which the alarm is transmitted by the human voice, by means of a phonograph attachment. The operation of the thermostat in this case causes a mechanism to become active, sounding an alarm at the receiving station of the fire alarm company. Then by automatically connecting a phonograph cylinder direct to the circuit, the operator at the station hears in a loud voice, by means of the phonographic arrangement, the necessary instructions pertaining to a fire alarm, the data being repeated a great number of times.

Niagara Falls, N. Y., was chosen as the next place of meeting, after which was read a paper prepared by Mr. W. H. Baker, general manager of the Postal Telegraph-Cable Company, New York, on the advantages and disadvantages of carrying high and low potential currents upon the same poles. The paper was to have been taken up by Mr. F. W. Jones, who, however, has recently sustained bereavement in the loss of his wife. Mr. Baker expressed the opinion that "the juxtaposition of wires carrying high and low potential currents must always be a source of more or less danger to life and property, despite all practicable safeguards." He advocated the complete separation of the two classes of high tension and low tension conductors, and approximately uniform municipal regulations as to all wires.

At the meeting on Thursday, Sept. 27, after the transaction of some routine business, the following were elected officers for the ensuing year: Morris W. Mead, of Pittsburg, president; J. T. Zeliff, of Paterson, N. J., first vice-president; M. McAllister, of Bradford, Pa., second vice-president; R. E. Moran, of Memphis, Tenn., third vice-president; F. P. Foster, of Corning, N. Y., secretary; Adam Bosch, of Newark, N. J., treasurer; M. J. Donohue, of Niagara Falls, N. Y., Captain William Brophy, of Boston, Mass., J. W. Aydon, of Wilmington, Del., Frank C. Mason, of Brooklyn, N. Y., F. G. Boyd, of Baltimore, Md., W. Y. Ellett, of Elmira, N. Y., G. F. Macdonald, of Ottawa, Ont., M. G. Canfield, of Grand Rapids, Mich., and F. L. Michael, of Peoria, Ill.

The treasurer's report showed a balance of $381 on hand. The convention then adjourned.

ADDITIONAL CONVENTION NOTES.

THE SKINNER ENGINE COMPANY, Erie, Pa., was represented by Mr. A. D. Skinner.

MR. C. O. BAKER, JR., represented Baker & Company, of Newark, N. J., manufacturers of platinum.

MR. GEORGE W. PROVOST looked after the interests of the General Railway Supply Company, of Pittsburg.

Mr. Thomas E. Fleming, special agent, Postal Telegraph-Cable Company, was in attendance at the convention.

Western Electric.—The interests of the Western Electric Company were looked after by Mr. John P. Barry, Jr.

Frink.—The interests of the I. P. Frink Company, New York, were well looked after by Mr. Frank Stout, their general traveling agent.

American Circular Loom Company and Electroduct Company were represented by Mr. H. B. Kirkland and Mr. Thomas G. Grier, of Chicago.

The Monarch Fire Appliance Company, of New York, was represented by Gen. C. H. Barney, Assistant general manager of the company, who exhibited and demonstrated the efficiency of Kilfyre.

The Doubleday-Hill Electric Company, Pittsburg, which is one of the biggest electric supply houses in that section of Pennsylvania, distributed a neat little coin purse at the convention bearing an inscription of its compliments.

Mr. W. Chandlee, of Richmond, Ind., general agent of the Gamewell Fire Alarm Company, looked after the interests of that company, and Mr. E. B. Chandler, secretary and treasurer of the Police Telephone & Signal Company, of Chicago, and also general Western agent of the Gamewell Fire Alarm Company, of New York, was in attendance.

The Pittsburg Transformer Company had a most interesting exhibit. It showed various types of transformers in parts, and how they were assembled, and Mr. F. C. Sutter explained transformers and the special features of their transformer in a most interesting way to the delegates.

Mr. Alex Henderson left the convention at its close under the impression that his rooms at the Monongahela, in behalf of the Sprague Electric Company, were the real headquarters of the association. There was much to confirm him in this pleasing delusion, and it is alleged that a roll-call of the members at any given moment would have located most of them within arm's length of the Sprague Company's tangible hospitality. It is a well-known fact that, at such conventions, more business is often done outside the meeting room than within it, and Mr. Henderson had engineered so neatly that when the delegates were not enjoying each other's oratory, they adjourned to see him.

Telephone Fire Service.

Mr. R. Guenther, consul general, Frankfort, Germany, writes: "There are fifteen brigade stations in Berlin, each of which is served by a special network of fire alarms. From these stations underground wires radiate in all directions, each wire being connected with a great number of alarm pillars. The alarms are arranged for automatic working, and to each is fitted a key for telegraphing to the station. As it is, however, a very great advantage to be able to maintain during the progress of the fire, a good connection between the alarm pillars nearest the fire and the brigade station, exhaustive trials have been made with a specially adapted telephone constructed by a large electrical firm, which have resulted in the general introduction of the same. To the Morse apparatus at the station a stand is attached, from which a microphone fitted with a battery switch and a second receiver are suspended. The remaining apparatus is inclosed in a flat box and placed under the table. This box contains an induction coil, a condenser and a circuit key. As it would be expensive to equip each of the fire alarm posts with telephone apparatus, a portable set is used, which may be attached to the posts by means of a plug and socket provided for the purpose. Such a portable set is carried by each of the brigade carts, there being some eighty now in use. The brigades' cycles are also equipped with sets which are very compact in design. Experience with the system has shown that the switching in of the telephone apparatus in no way influences the telegraph service. During simultaneous telegraphing and telephoning a slight knocking is perceptible in the telephone, which, however, does not destroy the audibility."

Electric Lighting in Brazil.

The British Acting Consul-General at Rio de Janeiro reports that there is a great field in Brazil for electric enterprise in developing traction, lighting and industrial operations, the numerous water courses furnishing unusual facilities for generating power. Quite recently a contract was placed with a United States firm for lighting the city of Juiz de Fóra (Minas Geraes) by electricity. The contract includes 50 street arc and 100 incandescent lights, and a capacity for 4000 incandescent lights of 16 candle-power each for private consumption. The power in this case will be derived from waterfalls distant 10 kilometers from the city.

The "Société Anonyme du Gaz de Rio de Janeiro," a Belgian company, has secured an extension of its privilege for lighting that city by gas until 1940, and by electricity until 1915. The distribution of electric current is to be subterranean and the system of lighting to be by arc lamps.

CURRENT NEWS AND NOTES.

THE GERMAN-AMERICAN CABLE.—A banquet was given in Berlin on the evening of Sept. 22 to celebrate the laying of the German-American cable.

TUBERCULOSIS.—At the recent meeting in New York City of the American Electro-Therapeutic Association, the report from St. Luke's Hospital as to tests of the cure of consumption by electricity was adverse in every case and in every particular.

THE ALASKA CABLE.—Gen. A. W. Greely, United States Army, Chief of the Army Signal Service, reached Seattle, Wash., on Sept. 29, from Alaska on the steamship Ohio. The steamer Orizaba, engaged in laying a Government cable between Nome and St. Michael, went aground on an uncharted reef near the latter place on Sept. 17. Gen. Greely was on board at the time, and says the vessel will be saved unless a sudden storm causes it to break up. The steamer Senator started at once for Nome to take off the crew and cargo, including the Government cable. The laying of the cable will be postponed until next season.

INTERNATIONAL RAILWAY CONGRESS TO MEET HERE.—The International Railway Congress, held this year in Paris, has accepted the invitation extended by the delegates of the American railways to meet at Washington, D. C., in October, 1904. This will be a fact of considerable interest to railway people of the United States, since this is the first time that the congress will have met in this country. The congress is made up of representatives from all the important railway companies in the world, and meets to discuss matters relating to railway operation. The last session before that of 1900 was held in London in 1895.

STEAM ROAD TROLLEYS.—The Boston & Maine has filed a petition with the New Hampshire Supreme Court asking for authority to build an electric road from Concord to Nashua. President Tuttle is in favor of the Boston & Maine building electric lines in connection with its system where the public good requires a railroad that will serve as feeders and produce a fair return on the investment. He says: "We have been operating an electric road at Portsmouth, N. H., for about two years with good results, and if granted authority will probably build between Concord and Nashua. In New Hampshire we have the right to build electric branches and we are taking advantage of that right, as fast as necessity arises, by building feeders for our steam road."

THE PARIS UNDERGROUND.—A cable dispatch from Paris of Sept. 29 says: The second branch of the Metropolitan Underground Road was opened to-day. It taps the main line at the Triumphal Arch and runs down to the Trocadero. Another line running north and south, connecting the Latin Quarter with Montmartre and passing under the river, will be opened next spring. French engineers, now holding a convention here, declare that even American enterprise could not meet the record of rapidity with which the line from Vincennes to the Bois de Boulogne was completed, it having been in operation 16 months after the first blow of a pick in the work of excavation. The distance is equal to that from the Battery in New York to 125th Street.

THE ENGLISH PACIFIC CABLE.—It is stated that the reason why contracts have not so far been let for the construction of the all-British Pacific cable is that the tenders submitted were considered, without exception, so extremely excessive that it was deemed inad-

visable to award a contract at present. A special cablegram just received from London states that the doings of the Pacific cable committee are closely guarded from the public, but it is understood that the matter stands thus: Tenders were received for the laying of the cable in response to an advertised invitation. These were considered and returned for amendment in some particulars. They have now been received back, and in a few days cablegrams will be sent to the Canadian and Australian governments announcing the acceptance of a certain tender, and the plans for the construction of the cable forthwith.

ELECTRIC CARS IN LONDON.—The London *Mail*, in a recent issue, contained the following interesting item anent the disadvantages under which Londoners labor by not having modern means of communication between the various sections of their city: "London to-day has the largest number of beautiful suburbs of any town in the world. But these beauties are largely shut off from any but the people living immediately around them, owing to the difficulties of travel. The man at Hampstead cannot visit Kew Gardens without spending two or three hours in getting there. The boy in Drury Lane cannot enjoy the glories of Hampstead Heath. The tired mother in the borough would regard a journey to Wimbledon Common as a more formidable undertaking than a trip to Southend. For all the use they are to the mass of the people, our splendid suburban walks might almost as well be non-existent. This is not going to be so much longer. The electric car is coming."

THE CHICAGO ELECTRICAL ASSOCIATION announces the following papers for the coming fall and winter: Oct. 5, "Electric Elevators for Safe and Economical Operation at High Speeds," Hayward Cochrane, electrical engineer, Eaton & Prince Company; Oct. 19, "The Alternating Arc," C. Wiler, Western Electric Company; Nov. 2, "Roentgen Rays," A. M. Blumenthal; Nov. 16, "Incandescent Lamp Photometry," W. B. Hale, Western Electric Company; Dec. 7, Chas Wirt, of Philadelphia, subject to be announced later; Dec. 21, "Electrical Features of the Paris Exposition," J. M. Hollister, Western Electric Company; Jan. 4, "Electricity in the Equipment and Construction of a Ship," C. C. Mattison, Chicago Ship Building Company; Jan. 18, "Standardization of Arc Lamps," H. Almert, Buckeye Electric Company. Meetings will be held as usual at 8 p. m. in the rooms of the Western Society of Engineers, 1737-41 Monadnock Block. Communications should be addressed to the secretary, R. F. Schuchardt, Chicago Edison Company, 139 Adams Street, Chicago.

AUTOMOBILES IN THE CAMPAIGN.—The high speed and other inherent advantages of the automobile are being recognized by political party managers, with the result that these vehicles are rapidly coming into use for campaign purposes. Col. W. J. Bryan, the Democratic nominee for the presidency, has been canvassing some parts of his own State—Nebraska—in a steam automobile, and even in New York City it is made use of. Mr. M. J. Harrington, the Republican candidate for the State Senate in the Twenty-first District, New York City, is conducting his campaign in an electric automobile. Besides its sidelights, the machine has a headlight of 250 candle-power, and two clusters of electric lights displayed on poles, one on each side of the vehicle. The principal advantage of the automobile for such purposes is, of course, its speed, which enables the speakers to reach quickly country districts difficult of access by the ordinary means; and in cities a greater area of territory can be covered in a given time. Thus the automobile is becoming an important agent in the education of the people.

AUTOMOBILE REGULATIONS IN CHEMNITZ.—Under date of Aug. 20, 1900, Vice-Consul Monaghan forwards the following regulations covering the running of automobiles in Chemnitz: (1) Persons under 15 years of age and persons who have no knowledge as to the management of such machines shall not be intrusted with the running of automobiles. (2) All persons who do not give their undivided attention to the management of automobiles or who while using the same fall asleep or get intoxicated are liable to punishment. (3) The signal to turn out shall be "Heeh." The use of signal horns will be permitted until further notice. (4) Every automobile must carry at least one very good lantern; the same shall be lighted at the same time as the street lights. (5) The speed of automobiles in the city shall not be faster than that of an ordinary trotting horse. No one shall run an automobile faster than a horse walks—(*a*) on leaving buildings or sheds bordering on the street; (*b*) during church service in the neighborhood of churches; (*c*) in places where there is large foot traffic; (*e*) in places where fast driving is forbidden. (6) Automobiles shall not be left unattended on the street. Any one disobeying these rules shall be punished.

THE UNITED STATES WEATHER BUREAU.—At present there are about 150 stations, and the work costs the nation something less than $1,000,000 a year of which $180,000 is for telegraph tolls, although great economy is effected in this direction by the use of a cipher code. Observations are received in Washington within an hour of the time at which they are taken, through an arrangement with the telegraph officials by which certain wires at certain hours of the day are held exclusively for the weather reports. The immediate value of the forecasts lies in their prompt distribution, and this begins with the morning forecasts within two hours after the instruments are read, first by telegraph and telephone, to about 1000 centres of distribution, thence by telephone, mail and railway service to more than 73,000 addresses, the greater part being delivered early in the day, and none later than 6 p. m. Besides the 1000 telegraph distributing centres, the forecasts are telegraphed at Government expense to about 1800 additional places to be communicated to the public by means of visual and sound signals, the former consisting mainly of flags and the latter of steam whistles, and there are in addition about 8000 emergency stations to which news of hurricanes, cold waves, frosts and local storms of unusual severity are sent when occasion warrants. Germany proposes to copy this system.

STREET CAR RAILS.—Mr. William Dawson, deputy engineer to the City of Bradford, read a paper at the recent meeting of the British Association on "Recent Tramway Construction," the chief feature in which was a description of the Demerbe rail, which has been in successful use for some time in Bradford. This rail consists of a hollow trough rail. The fishplates, by which the different lengths are joined, are placed inside under the ends of the rails and exactly fit their contour, the point of application being immediately under the head of the rail. By means of cotters the fishplates are driven close up to the under side of the rail. When in position the rail is completely filled with concrete. The tie bars are flat. The rail is inserted into two oblique grooves, one of which is cut so as to exactly fit its outer side, while the other is wider to facilitate its introduction. The space left is filled up with a wedge of soft steel. In this way the rail becomes attached to the concrete foundation and is actually a part of the carriage way. It will therefore withstand the strains caused by the cars and also all other strains and vibrations caused by ordinary vehicular traffic without any loosening of the joints or displacement of the paving. The first cost was shown to be cheaper than ordinary rails, though this was considered by the author as of secondary importance to the saving in maintenance. The system has been in use in Leeds six years, and the author considered that no repairs would be necessary during the life of the rail, once it is properly laid. The life he would estimate to be about 20 years.

THE POWER USED IN RUNNING TRAINS.—Mr. A. Mallock read a short paper, at the recent meeting of the British Association, on "The Measurement of the Tractive Force, Resistance and Acceleration of Trains." The author described in the paper some experiments recently made on electric and other railways, the object of the experiments being to determine the acceleration, tractive force and running resistance to which the trains are subject. The appliance used was a short pendulum whose free vibrations are adequately damped. If this is suspended on the moving body it will hang in the direction which is the resultant of gravity and the acceleration which the body at the time experiences; hence the angle which such a pendulum makes with the vertical gives the measure of the accelerations at each instant. In the experiments the penlulum was arranged so as to record its position on uniformly moving paper, on which at the same time seconds were marked by an electric clock, and a contact marker, worked from one of the wheels of the carriage, caused a second pen to record each revolution performed by the wheel. The diagram thus obtained gives a direct measure of the speed and acceleration of the carriage. The author showed that pendulum observations, combined with a record of speed and power supplied, offered a simple and effective means of determining the resistance to, and efficiency of, electric or other kinds of motor vehicles. Sir W. H. Preece and Mr. A. Siemens bore testimony to the great usefulness of Mr. Mallock's methods. His apparatus, being automatic, was absolutely immune from the liability to error of the human equation.

LETTER TO THE EDITORS.

Resonance or Coherence?

To the Editors of Electrical World and Engineer:

SIRS:—The *London Electrician* and *Nature* contain notes about a phenomenon observed during severe thunderstorms on the circuits of the Calcutta Electric Supply Company. It is described in *Nature* in the following words: "It appears that immediately following each lightning flash the brightness of the glowing lamps has been observed to increase suddenly, gradually returning to the normal incandescence. This phenomenon has so frequently been observed that the engineers of the company have sought every possible explanation of the curious phenomenon, but have been unable to find any defect in their circuits —which are on the overhead wire system—that might offer an explanation." The explanation is then found in the supposition that the resistance of the carbon filaments is lowered by electric radiation.

In your issue of Sept. 22 Mr. L. S. Levy comments on this observation and explains it as an effect of resonance.

For the past year I have often noticed the increased brightness of incandescent lamps during a thunderstorm. My house stands isolated on the high bluff of Lake Erie, receiving direct current of 220 volts by two overhead wires. Though the line is provided with lightning arresters, and though the house is very carefully rodded, yet there hardly ever occurs a thunderstorm without causing the lamps to flash up or to blow out some fuses. The lamps have often flashed up brightly, though the switches interrupted the circuit. This *may* well be a resonance effect, but it *need* not be. It might occur with either oscillatory or continuous discharges; the latter may even be more effective as regards the phenomenon in question. It surely is a very far-fetched hypothesis to connect this phenomenon with electric radiation. Resonance—or syntony, as Oliver Lodge calls it—is likely to play some important part, the natural vibration period of the circuit being equal to some period of the oscillatory discharge.

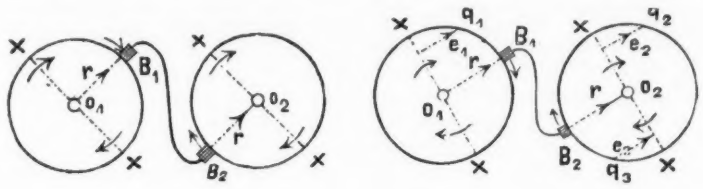
Erie, Pa. B. A. BEHREND.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

Temporarily Conducted by E. F. ROEBER, Ph. D.

DYNAMOS. MOTORS AND TRANSFORMERS.

Synchronous Converters.—An illustrated article on a machine of the Helios Company. It has been sometimes proposed to use a stasionary armature, a rotary field and revolving brushes for converters from alternating current into direct current (see, for instance, Digest, Feb. 17, March 17, the papers of Hermann and Simek); but such an arrangement has not found, so far, any practical application, because there were great mechanical difficulties in the collection of the direct current by means of rotating brushes. In the machine of the Helios Company the current is taken off from stationary points, so that the function of the brushes becomes less important. The principle of the machine may be seen from the adjoining figures, where the vectors represent e. m. f.'s. There are two separate windings on the same armature and the same rotary field revolves in both. For sake of the illustration the two windings are shown in the figure separately, side by side, each with a separate rotary field, the directions of the fields being always parallel to one another and repre-



FIGS. 1 AND 2.

sented by the lines $x\ x$; O_1 and O_2 are the neutral points; at the two points B_1 and B_2 the e. m. f. is a maximum and may be $= r$; if the brushes are placed at these points and if they are revolved synchronously so that they are always at the end of the radius perpendicular to the direction of the magnetic field, and if these brushes are connected by a conductor, the e. m. f. between the neutral points O_1 and O_2 is constant $= 2\ r$. In Fig. 2 the direction of the rotary field and the position of the brushes is the same as just described, but the current is taken off from the stationary points q_1 and q_2; the e. m. f. between the same is $2r + e_1 - e_2$; both e_1 and e_2 vary between $XX + r$ and $-r$, so that the e. m. f. between q_1 and q_2 can never be negative. If q_1 and q_2 have the same position relative to the direction of the field (as shown in Fig. 2), e_1 is always equal to e_2, and the e. m. f. between q_1 and q_2 is always $2r$. If, however, q_1 and q_2 have just the opposite position relative to the direction of the field so that e_1 is always equal to e_2, but of opposite sign, then $e_1 - e_2$ varies between the values $2r$ and $-2r$, and the e. m. f. between q_1 and q_2 varies between $4r$ and O.—*Elek. Rund.*, Sept. 1.

REFERENCES.

Theory of Alternators.—POTIER.—A theoretical paper on the armature reaction of alternators. He refers to the papers of Behrend, Rothert and Arnold (Digest, Jan. 13; ELEC. WORLD AND ENG., Jan. 27 and Feb. 3.) The short circuit curve allows to predetermine the required excitation only for low saturations. In general two different coefficients must be known; for higher saturation the second coefficient, which depends upon magnetic straying, plays a very important part.—*L'Eclairage Elec.*, July 28.

Synchronous Converters.—GRIER and HYDE.—A paper read before the Can. Elec. Ass'n. They give several diagrams showing the wave form on a synchronous converter under different conditions of load; the curves show that armature reactions are very small and the wave form approaches very near a sine wave, practically holding it under all conditions of load. They then discuss the method of compounding a synchronous converter by means of impedance coils in the line. They also deal with the use of synchronous converters in street railway work, and with the application of "inverted rotaries" for transforming direct into alternating current.—*Can. Elec. News*, Sept.

Synchronous Converters.—MAYER.—A long illustrated French abstract of the German paper, noticed in the Digest May 5.—*L'Eclairage Elec.*, July 7.

Continuous Current Dynamos with Two Independent Windings.—SENGEL.—A very long illustrated French abstract of the German paper noticed in the Digest Aug. 19, Sept. 2.—*L'Eclairage Elec.*, July 7.

LIGHTS AND LIGHTING.

Artificial Light Like Daylight.—DUFTON and GARDNER.—An abstract of a paper read before the Brit. Ass'n for the Adv. of Sc. on "The production of an artificial light of the same character as daylight." The need of an artificial light which should so closely resemble daylight as to show colors in their true relationship has long been felt by workers in colors. The peculiar character of daylight is due essentially to the modification produced by the atmosphere in the light from the sun. As the electric arc light is nearest daylight in character, they have attempted to imitate by direct absorption the effect produced by scattering in the atmosphere. The light of an arc lamp consists of two distinct parts: The light from the glowing carbons, and the light of the arc itself, characterized by its richness in violet rays. In lamps of the enclosed arc type the length of the arc is increased, and consequently such lamps give a light richer in violet rays. Although arc lamps vary somewhat in the proportion of violet light, they all agree in being richer than daylight in the amount of red, orange and yellow rays, compared with the amount of green and blue. Owing to the peculiar transparency of colors to red light, it is of primary importance that the proportion of red light should be carefully adjusted. Small variations in the amount of violet light are of minor importance. The required absorption of the less refrangible rays can be effected by means of blue cupric salts. A solution of copper sulphate shows strong absorption at the extreme red of the spectrum, the absorption extending with diminishing intensity into

the green. For practical purposes the light from the arc is modified by passage through pale blue glass covered by means of copper. This colored glass may conveniently take the form of a globe replacing the ordinary globe of the arc light.—Lond. *Elec.*, Sept 14.

POWER.

Refuse Destructor.—McTAGGART.—A paper, read before the Brit. Ass'n for the Adv. of Sc., in which he described the methods and the results of the disposal of house refuse in Bradford. In the discussion which followed he said that the generation of electric power from refuse was a subject which had received the consideration of the Cleansing Committee of Bradford, but so far they had not yet seen their way to go any further into the matter than simply to light their own plant and the limited area adjoining it. The calorific value of the refuse they found to vary so much from day to day that they hesitated to place themselves in any position where they might be expected to deliver a certain amount of power which they would find they would be unable to do without using coal. In his opinion they should not try to have a duplicate plant at all. "If they wished to have an electric lighting works, let them have one, and thoroughly up-to-date; if they wanted a destructor, let them have it as a destructor, and make that thoroughly up-to-date." The power from the refuse should then be utilized in some other useful work; for instance, in the manufacture of concrete bricks and of ornamental tiles from clinker. He thinks that would some day prove to be as thoroughly remunerative as the generation of electricity. The paper is also discussed in an editorial.—Lond. *Elec. Rev.*, Sept. 14.

Power Generation.—KERSHAW.—An abstract of a paper read before the Brit. Ass'n for the Adv. of Sc., on the comparative cost of power generation by the steam engine, water turbine and gas engine. The figures given in his tables support the general opinion that water, when developed without excessive capital expenditure, is the cheapest source of power; when, however, the hydraulic engineering expenditure has been heavy, or when the power, after generation, must be transmitted over long distances, the margin between the relative costs of water and steam power is greatly narrowed, and in some cases disappears. He then takes the question of the practicability of large gas engines as settled, and says that if they do not cost excessive sums for maintenance and repairs, large gas engines, in conjunction with coke ovens and blast furnaces, may entirely alter the present status of affairs, and in coal and iron districts they may successfully compete with water power.—*El'ty*, Sept. 26.

REFERENCES.

Water Power Plant in Illinois.—An illustrated article on "Power development of the drainage canal at Joliet, Ill." The plant, which is in course of erection, will have 40 turbines, and a total of 8000 horsepower will be developed. The available maximum at head of the dam is only 15 ft., while the lowest limit reaches 9 ft., the average being about 12 ft.—*West. Elec.*, Sept. 22.

Electric Power in a Smelting Plant.—An illustrated description of the electric plant of the Smelting Corporation at Ellesmere Port, Cheshire, where the Fry process for the extraction of the metals contained in refractory sulphide ores is in operation. The plant is electrically lighted, and there are some 30 direct current motors, ranging from 5 to 100 horse-power, for crushing, grinding, briquette making, etc.—Lond. *Elec. Rev.*, Sept. 14.

Traveling Crane.—Two communications on the question how to determine the proper size and lifting power of a traveling crane for an electric generating station.—Lond. *Elec. Eng.*, Sept. 14

TRACTION.

Quebec.—BLAIR.—An illustrated paper, read before the Can. Elec. Ass'n on "The condition of operation of street cars in the City of Quebec." He describes the overhead construction and deals with the current consumption of the cars on grades. The current required to get a loaded car up the steepest grades on a good summer rail is practically constant and well within the overload capacity of the car motors; the maximum current usually drawn from the line at 520 to 540 volts under such conditions is rarely above 125 amperes, and that for a short time only; the average current is from 60 to 80 amperes per car. In winter time, however, with ice and snow on the rails, every equipment on the road has frequently to stand each day an overload of from 50 to 120 per cent, while on the driving motors on the sweepers frequently an overload lasting an appreciable time of 180 to 200 per cent has been measured; these sweepers have cleaned over 6000 miles of track every year for the last three years, with only one small mishap. The total cost of maintenance of electric equipment per car mile per year is 17 cents. All cars are electrically heated during six months.—*Can. Elec. News*, Sept.

REFERENCES.

Single Rail Express Railway.—Two papers on the proposed Manchester and Liverpool express railway, noticed before in the Digest. It is to be worked electrically at a high speed; its main principle is the suspension of the coaches on a single elevated rail so that their centres of gravity are 15 ins. below the top of the rail; each coach sits the rail like a saddle. The first paper, by Preece, deals with the general arrangement of this proposed railway; the second paper, by Behr, who has designed this road, deals with the brakes and signals. The discussion which followed is also abstracted.—Lond. *Elec. Eng.*, Sept. 14.

Train Resistance.—BARBILLION.—A long article, with many diagrams and tables. The first gives a summary of the methods and formulas used to find the train resistance in general, and then deals at some length with the researches of Lundie and MacMahon.—*L'Eclairage Elec.*, July 21, Sept. 8.

Conduit System.—A brief illustrated description of "a simple closed conduit traction system," devised by Maxham and operated by the Bay State Traction Company.—*Elec. Rev.*, Sept. 19.

Track Construction.—DAWSON.—A paper read before the Brit. Ass'n for the Adv. of Sc. on "Recent tramway construction, with special reference to the Demerbe system."—Lond. *Elec. Eng.*, Sept. 14.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Electric and Gas Plants.—ADAMS.—An article in which he suggests to combine the management of an electric plant and the gas plant of a city. Simple coal gas may be generated and distributed without enrichment, and the resulting coke, instead of undergoing reduction to water gas, to contain only 40 per cent of its energy, will transfer 80 per cent of its heat to steam. The simple coal gas thus produced can be sold at a profit at a much lower price than that now charged for carburetted water gas; the lower price will work a large extension of the use of gas for cooking and manufacturing purposes. The illuminating power of the coal gas will be lower; incandescent mantles will have to be used, and there will be also a tendency to a decided increase in the demand for electric light. The coke produced and stored at an outlying gas plant is burned in one or more electric plants centrally located; in such a location most of the heat that would otherwise be wasted can be sold to warm buildings.—*Elec. Rev.*, Sept. 19.

REFERENCES.

Condensers.—BOUCHEROT.—His paper, read before the Internat. Elec. Congress, which was noticed in the ELEC. WORLD AND ENG. Sept. 22, p. 450.—*West. Elec.*, Sept. 22.

Power Factor.—LEONARD.—A paper read before the Can. Elec. Ass'n, in which he discusses the power factor of an alternating current system as affecting operation and investment, with special reference to synchronous motors, induction motors, and arc lamps.—*Can. Elec. News*, Sept.

Electric Installation on Board Ships.—Two communications on the question of which pole of the dynamo should be connected to the ship, if only one insulated wire is used and the ship is used as the return; four recommend to connect the negative pole to the ship, while the fifth proposes to change the dynamo leads over every few weeks or months, so as to make the ship sometimes negative and sometimes positive.—Lond. *Elec. Eng.*, Sept. 14.

Switch Gears.—A continuation of the illustrated serial on switch gears for high pressure alternating currents (Digest, Sept. 22). In this part switch gears of the Electric Construction Company and of Cowan are described.—Lond. *Elec. Eng.*, Sept. 14.

Motor Starting.—An illustrated description of two new motor starting switches, brought out by a British company.—Lond. *Elec.*, *Elec. Eng.*, Sept. 14; *Lightning*, Sept. 13.

Rathmines.—An illustrated description of the municipal electric plant of Rathmines, near Dublin. The direct current three-wire system is used, the current being supplied to the consumers at a standard pressure of 220 volts for lighting and small motors, and 440 volts for motors requiring more than 5 kilowatts.—Lond. *Elec. Rev.* and *Elec. Eng.*, Sept. 14; *Lightning*, Sept. 13.

Prague.—BATHURST.—The conclusion of the illustrated description of the power plant of Prague, noticed in the Digest Sept. 8.—Lond. *Elec. Rev.*, Sept. 14.

Glasgow.—The first part of an illustrated article on the two recently opened new municipal electric plants of Glasgow. This part gives historical data on the development of the electric supply in Glasgow.—Lond. *Elec.*, Sept. 14.

ELECTRO-PHYSICS AND MAGNETISM.

Magnetic Behavior of Liquid Crystals.—LEHMANN.—He defines crystals as not isotropic and possessing a molecular directive force which governs their shape and the distribution of accretions; the directive force is preserved by means of the surface tension, and crystals may therefore be liquid or solid, but they cannot be gaseous. In a magnetic field liquid crystals show a distinct tendency to place their axes of symmetry normal to the lines of force.—*Ann. der Physik.*, No. 8; abstracted in Lond. *Elec.*, Sept. 14.

Electrostatic Rotation.—DELL.—A continuation of his serial (Digest, Mar. 10). He describes some further experiments with rotating disks. He studied the effects from humidity in the air on the rotation. He observed that when the same electrodes had been used for some time and had not been cleaned, if the primary current of the induction coil was reversed, the disk used would start and rotate always in the same direction it did before the current had been reversed; the reason is said to be that the negative point becomes more tarnished than the positive, and when the current is reversed, the extra tarnishing of the former negative point offers more resistance to the discharges of the new positive than the old positive did.—*Elec. Rev.*, Sept. 19.

REFERENCES.

Ether.—LARMOR.—The conclusion of his address on modern molecular theories and the ether (Digest, Sept. 29).—Lond. *Elec., Elec. Eng.*, Sept. 14. The full address is reproduced in *Science*, Sept. 21.

Electromagnetic Mechanisms.—S. P. THOMPSON.—His paper, read before the Internat. Elec. Congress, which was abstracted in the ELEC. WORLD AND ENG. Sept. 15, p. 411.—*Elec. Rev.*, Sept. 19.

Electricity and Magnetism.—FESSENDEN.—A communication in which he replies to the criticism of W. A. P., noticed in the Digest June 16. He maintains that the main results of his theory will stand. —Lond. *Elec. Rev.*, Sept. 14.

Cathode Rays.—PHILLIPS.—A paper read before the Brit. Ass'n for the Adv. of Sc. "On the apparent emission of cathode rays from an electrode at zero potential." He describes experiments made by him to clear up an observation which he has formerly made.—Lond. *Elec., Elec. Eng.*, Sept. 14.

Electric Lines of Force.—ROBERTSON.—A reprint of his illustrated article on dust figures of electrostatic lines of force (Digest, Sept. 29).—*El'ty*, Sept. 26.

Hall Effect in Gases.—MARX.—An account of experiments in which he has succeeded in finding in flame gases a Hall effect which is distinctly appreciable, though necessarily small. The Hall effect in electrolytes will probably remain too small for measurement.—*Ann. der Physik*, No. 8; abstracted in Lond. *Elec.*, Sept. 14.

ELECTRO CHEMISTRY AND BATTERIES.

Commelin and Viau Storage Battery.—An illustrated description of two types of this battery. The first form is characterized by the use of sulphate of cadmium as electrolyte and by the fact that during the discharge of oxygen is utilized which has been developed during the charge at the anode. An experimental form of the battery is shown in the adjoining diagram, where *G* is a glass vessel, *L* is an electrode of lead, *C* is the other electrode, which is hollow, and consists of porous carbon; *M* is a manometer. During the charge the sulphate of cadmium is decomposed and cadmium is precipitated at the cathode *L*, while sulphuric acid is formed and oxygen is developed at the anode *C;* the oxygen is distributed through the upper part of *G* and the globe above it and is brought from there through the tube *S* into the interior of the hollow anode *C*. The charging is finished when the pressure, measured at the manometer, is 1 kilogram per cm². For the discharge the cock *T* is closed; hydrogen is developed at the electrode *C*, which combines with the oxygen accumulated in the pores of the carbon, while at the electrode *L* sulphate of cadmium is formed. The e. m. f. of this battery is 1.5 volts. He gives also an illustration of a commercial form of this type of battery, and describes a second type, in which the electrode *C* is not carbon impregnated with oxygen, but a peroxide of lead plate; the e. m. f. of this cell is 2.2 volts.—*L'Eclairage Elec.*, June 23.

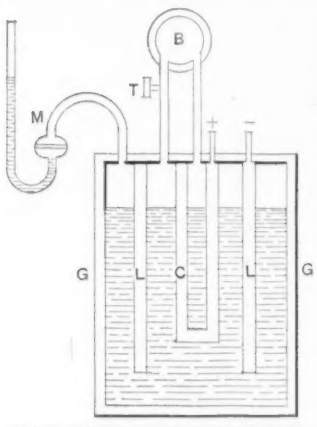


DIAGRAM OF STORAGE BATTERY.

Frasch Electrolytic Process.—THUN.—A communication referring to the Frasch process (Digest, Sept. 22). He says that there are several technical difficulties in such a process which is extremely simple in theory; for instance, failure of electric connection at the anode through the particles of matter becoming coated with sulphur, which will remain predominant and as the metallic contents are dissolved, diffusion of the liquids, etc.; the greatest difficulties would occur in the second operation of the Frasch process, namely, the recovery of the copper and the nickel from the chloride solution. He thinks that it would be much simpler to deposit refined copper instead of producing caustic-soda solution on the cathode with or without the use of a divided cell. The high cost of depositing nickel electrolytically from its solutions has been the drawback in treating the so-called Bessemerized Sudbury copper-nickel mattes; these mattes when used as anodes in the form of slabs, yield up their copper in beautiful form on the cathode, leaving all the nickel and iron and very little copper in the electrolyte; he, therefore, believes that the subsequent economic extraction of the nickel from its solutions is the only problem which needs to be solved to make the electrolytic separation of nickel and copper a commercial success.—*Eng. and Min. Jour.*, Sept. 22.

Cleaning of Metallic Surfaces.—REYVAL.—A description of an electrolytic process of the United Electric Company, of Vienna, for cleaning metallic surfaces. The article, which is to be cleaned, is suspended as one electrode in a solution of an alkaline salt; as the other electrode is used a plate of carbon or of a metal which is not attacked by the solution or by the products of electrolysis. If the article to be cleaned consists of iron or copper, it is used as the anode; if it consists of zinc or aluminum, it is used as the cathode. In the first case, the anion of the electrolyte combines with the metallic article and a salt is formed which is distributed by diffusion in the bath until it reaches the potash or soda formed at the cathode; a reaction occurs and the alkaline salt which forms the electrolytic bath is reproduced, while the oxide of the metal of the anode is precipitated.—*L'Eclairage Elec.*, July 21.

Electrolytic Conduction.—CAMICHEL and SWYNGEDAUW.—An account of experiments relating to electrolysis without electrodes. One of their experiments is said to prove "that an electrolyte can be traversed by a current without any electrolysis taking place, or at least none which involves the evolution of gas." They also formed a chain consisting of sulphuric acid, sodium chloride and potash; the contact surfaces were renewed by continuous circulation; the sensitiveness of the galvanometer used was not sufficient to place a current in evidence.—*Comptes Rendus*, Aug. 6; abstracted in Lond. *Elec.*, Sept. 7.

REFERENCES.

Storage Battery—JUMEAU.—A paper on the use of a small auxiliary electrode of pure spongeous lead for experimental investigations of the storage battery, with reference to the paper of Schoop (Digest, April 7).—*L'Eclairage Elec.*, July 14.

Electric Furnaces for Producing Calcium Carbide.—CARLSON.—A long French abstract of the German paper noticed in the Digest Mar. 17, Apr. 7.—*L'Eclairage Elec.*, July 14.

Electrolytic Production of Hypochlorites.—SIEVERTS.—A very long French abstract of the German paper noticed in the Digest Feb. 24.—*L'Eclairage Elec.*, July 21.

UNITS, MEASUREMENTS AND INSTRUMENTS

Standard Resistance Coil.—WHIPPLE.—An illustrated paper read before the Brit. Ass'n for the Adv. of Sc., in which he describes a form of a standard 1-ohm coil, the wires of which are bare and immersed in oil, with a special device for obtaining the temperature of the coils. The coils proper consist of 0.035-in. platinum-silver wire wound on mica frames, the ends of the wires being attached to stout copper terminals. A 0.008-in. platinum wire is wound alternately with the platinum-silver wire, and is attached similarly to stout copper leads. As the temperature coefficient of platinum is about 15 times as great as that of platinum-silver, a small change in the tem-

perature of the coils causes a comparatively large difference between the resistances of the two coils. When this difference has been determined, the temperature can easily be found by means of a table. The coils are placed in a glass vessel in order that the behavior of the insulating oil with time may be studied.—Lond. *Elec.*, Sept. 14.

REFERENCES.

Electric Units.—HOSPITALIER.—An article on electric quantities and units, nomenclature and definitions, symbols and abbreviations, comprising his propositions to the Internat. Elec. Congress.—*L'Ind. Elec.*, Aug. 10.

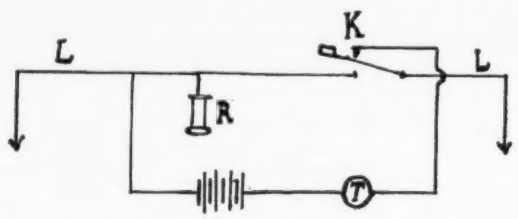
Alternating-Current Meters.—ARMAGNAT.—An article giving well-illustrated descriptions of new alternating-current meters, taken from patent specifications. Meters of Hookham, Pratt, Davis and Conrad, and Siemens Bros. & Company are described.—*L'Eclairage Elec.*, July 21.

Electric Brake Dynamometer.—GRAU.—An illustrated French abstract of the German paper noticed in the Digest May 12.—*L'Eclairage Elec.*, July 14.

Plotting Hysteresis Loops.—KALLIR.—A long, illustrated French abstract of his German paper on the use of Braun's cathode-ray tube for plotting hysteresis loops, noticed in the Digest May 12.—*L'Eclairage Elec.*, July 7.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telephony.—PREECE.—A paper read before the Brit. Ass'n for the Adv. of Sc., in which he gives an account of experiments made by him since 1894. "Wireless telephony across the sea is now a practical and commercial system." The maximum effects are produced when the parallel wires are terminated by earth-plates in the sea itself, as the ordinary inductive effects are much enhanced by conductive effects through the water, so that shorter wires are practical. No special apparatus seems necessary; the ordinary telephonic transmitters and receivers are used. The connections are shown in the adjoining diagram. *L L* is a line wire earthed at either end, *R* a telephone receiver, *T* a transmitter, and *K* a key which has to be depressed when a message is being received. In the discussion which followed Lodge said that he had always found that earth connections increase very much the range of such systems of telegraphy or telephony; he signals between his college and private house over a distance of two miles with an exceedingly small distance between the earth plates. West gave an account of experiments made by him on a lake in Germany; a line was erected along the shore of the lake, ending in two earth-plates; the receiving line was connected between two yachts on the lake, one of these being anchored, the other moving round; he found that when the two vessels were in a line perpendicular to the sending wire on shore, no signals were received; he concludes from this that the signals were sent out by induction and not by conduction.—Lond. *Elec. Eng.* and *Elec.*, Sept. 14; (see E. W. & E., Sept. 22).



CONNECTIONS OF WIRELESS TELEPHONY.

Telegraphy.—CAMP.—An illustrated paper read before the Can. Elec. Ass'n on "The use of the dynamo and storage battery in telegraph offices." He gives a historical résumé, deals with duplex and quadruplex telegraphy, and describes the systems of transmission of the Western Union and the Postal Company. He concludes that the adoption of either dynamos or storage batteries for telegraph lines has very materially improved the working of the lines, and at the same time effects a great economy; one or the other will gradually replace gravity batteries for all main lines, and the time may come when even the locals at wayside stations will be worked by storage battery cells, which will be charged at some central point and sent out by train.—*Can. Elec. News*, September.

REFERENCES.

Pacific Cable.—An article on the specification for the proposed Pacific cable. Some criticism is made on a clause in the specification that "each coil of core shall, if required, be submitted to an alternate e. m. f. of at least 5000 volts, this electrical pressure to last 15 minutes on each coil."—Lond. *Elec.*, Sept. 14.

Wireless Telegraphy.—DEROME.—The first part of an illustrated article, in which he gives a summary of recent progress in wireless telegraphy. He describes the device of Tommasi for restricting the chances of interception of wireless telegrams to a small zone (Digest, July 7).—*La Nature*, Sept. 15.

Telegraphone.—An illustrated description of Poulsen's instrument.—*Sc. Amer.*, Sept. 22.

REFERENCES.

Experiments Illustrating Syntony.—SHAW.—His Brit. Phys. Soc. paper in full, an abstract of which was noticed in the Digest April 21. He gives a brief summary of the theory of magnetic space telegraphy (Lodge's paper, Digest Jan. 7, 28; Feb. 4, 1899), and describes lecture room experiments for demonstrating the theory of syntony.—*Phil. Mag.*, September.

Wireless Telegraphy.—A reprint of the illustrated English article on the Slaby-Arco system, abstracted in the Digest Sept. 22.—*El'ty*, Sept. 19.

Protection of Telegraph and Telephone Wires in Connection with Overhead Traction.—QUIN.—A reply to the criticism contained in the article noticed in the Digest Sept. 22.—Lond. *Elec. Rev.*, Sept. 7.

Recording Telephone.—RUHMER.—A brief description of a recording telephone devised by Dussand, in which a lond-speaking telephone is combined with a phonograph with a wax cylinder.—*Phys. Zeit.*, Sept. 8.

Telegraphy.—REMY.—Two articles on modern telegraphy, the first giving some historical and statistical data, the second a description of different instruments and apparatus, used in telegraphy, with illustrations.—*Cosmos*, May 5, Sept. 8.

Munich.—Continuation and conclusion of the long, illustrated article on the new telephone exchanges of Munich, Germany (Digest, Sept. 15).—*Elek. Zeit.*, Aug. 30, Sept. 6.

Philippines.—An illustrated article on telephone work and prospects in the Philippines.—*West. Elec.*, Sept. 8, 15.

Block Signals.—PRASCH.—The first part of an illustrated article on the Krizik system of electric block signals.—*Elek. Neu. Anz.*, Sept. 1.

MISCELLANEOUS.

Non-Permanence of Weight.—HEYDWEILLER.—An account of experiments which appear to shake the axiom of the indestructibility of matter. Landolt's researches in 1893 embodied the first work done in this regard with all the modern instruments of precision; certain minute changes of weight were then placed in evidence, and these have since been confirmed. The present author has endeavored to trace some connection between the change of weight and the changes in other physical properties, but without results. He has, however, "distinctly established a diminution of weight of about 1 part in 50 millions in a number of reactions, such as the mixture of copper sulphate with water."—*Phys. Zeit.*, Aug. 25; abstracted in Lond. *Elec.*, Sept. 14.

Electric Furnace.—A description of the Durcasse electric furnace which is circular in plan with a movable hearth, the whole of which acts as the negative electrode. There are four carbon rods forming the positive electrodes; they are supported from above in such a way that their position may be regulated automatically or at will. By means of a motor working on a shunt from the main circuit, a rotary switch causes the main current to pass through each of the electrodes in succession 3000 times a minute, contact with any one carbon not being broken until that with the next has been made, so that sparking is avoided; there is in this way produced in the hearth of the furnace an arc which practically rotates at 3000 r. p. m.—*Ind. Electrochim.*, November, 1899; abstracted in *Brit. Inst. Civ. Eng. Abstracts*, v. 141, Pt. 3.

Gutta-Percha.—HILL.—An article on the "increase of gutta-percha in electric cable building." According to a list of Supf of proposed new cable lines, the length of the new lines aggregates to 66,176 nautical miles, while the length of lines in operation in the beginning of 1900 was 177,989 miles. As there would be needed about 28,000,000 lbs. of commercial gutta-percha for the new lines, it would appear that such large requirements are not likely to be met very soon; he believes, however, that there is no reason for alarm, as probably the actual construction in the near future will not be at a

greater rate than for some years past. He gives some data about the exports of gutta-percha from Singapore. If there should be, however, a falling off in the gutta-percha supply, india-rubber remains as an insulating material which may be used to advantage, especially on short lines.—*Elec. Rev.*, Sept. 12.

REFERENCES.

British Association.—An account of the proceedings of the recent Bradford meeting of the Brit. Ass'n for the Adv. of Sc. Some of the papers which have been published are abstracted in other columns of the Digest. Professor Ruecker has been nominated president for next year, when the meeting will be held at Glasgow.—Lond. *Elec.*, Sept. 14; *Lightning*, Sept. 13.

Canadian Electrical Association.—A full account of the proceedings of its recent annual meeting in Kingston (Elec. World and Eng., Sept. 8).—*Can. Elec. News*, September.

Electric Sparking Devices.—Poddlesack.—An article on electrical ignition of gas engines.—*Mod. Mach'y*, September.

Rubber.—An article on the rubber industry of the Amazon Valley.—*Jour of the Soc. of Arts;* Lond. *Elec.*, Sept. 7.

Manufacturing Glass Electrically.—Bermbach.—Continuation and conclusion of his article on some physical phenomena in the electric manufacture of glass (Digest, Sept. 8).—*Elek. Anz.*, Aug. 26, Sept. 9.

Metal Market.—Diagrams showing the fluctuations of the price of zinc, lead, iron, tin, copper during the month of August.—Lond. *Elec. Rev.*, Sept. 7.

Electric Cure for Tuberculosis.—An article giving some information on the Crotte method (Digest, May 5, Aug. 25). It is said that, since 1894, 800 tuberculosis patients in France have been treated by this method, and 600 of these have been completely cured.—*El'ty*, Sept. 19.

Paris Exposition.—Scott.—An illustrated article on high-power, single-cylinder engines, driving alternators.—Lond. *Elec. Rev.*, Sept. 7.

Perkins.—An illustrated article on some machine exhibits of Swiss firms.—*West. Elec.*, Sept. 15.

Boyer.—An illustrated article on electrical exhibits of firms other than French.—*Cosmos*, Sept. 8.

An illustrated article on exhibits of Keiser & Schmidt, Berlin.—*Elek. Anz.*, Aug. 30.

An article on exhibits of cable manufacturers.—*Elek. Anz.*, Sept. 2.

An illustrated article on the searchlights and lighthouse of the Eiffel Tower.—*La Vie Scient.; El'ty*, Sept. 19.

An illustrated article on engines exhibited by Sulzer Bros.—Lond. *Elec. Rev.*, Sept. 14.

Illustrated articles on the Nernst lamp exhibit.—*Elec. Rev.*, Sept. 19; *West. Elec.*, Sept. 22.

A continuation of the well-illustrated serial, giving descriptions of machine sets exhibited by German firms.—Lond. *Elec.* Sept. 14.

A well-illustrated description of exhibits of Schuckert & Company.—*Zeit für Beleucht.*, Aug. 30, Sept. 10.

De Morsier.—An illustrated description of machines exhibited by the Oerlikon Company.—*Revue de l'Elec.*, Sept. 15.

An illustrated description of an electric locomotive, exhibited by Schneider & Conmpany.—*L'Ind. Elec.*, Aug. 10.

New Books.

Our New Prosperity. By Ray Stannard Baker. New York: Doubleday & McClure Company. 267 pp. Price, $1.25. Cloth, illustrated.

The period of prosperity which dawned upon this country in 1897 and which, we are happy to say, still continues, is very strikingly delineated in this compact little volume. It is a mass of data and statistics, but they are not repellant. On the contrary, Mr. Baker has set them forth most attractively, and has accompanied his always lucid text by some very clever drawings in which the comparative figures are shown graphically. Although the tide of prosperity has broadened and deepened, Mr. Baker does not wish his readers to think that it must always be so, for out of the very facts he elucidates come undue expansion and overtrading. Still, the admonition to be prudent, while it will serve a useful purpose, can by no means check the career of the United States as a world trade power, and it is remarkable that, if anything, seasons of depression compel our manufacturers and merchants to push exporting more than do such halcyon days as those which are Mr. Baker's encouraging theme.

Eléments du Calcul et de la Mesure des Courant Alternatifs. By Omer de Bast. Paris & Liege, 1900: Ch. Beranger. 190 pages, 75 illustrations.

This little book is an extract from the course in electricity of the Industrial School of Liege, and is designed to give in a condensed form the principles and methods of calculation and measurement of alternating currents. The author has particularly limited his explanations and demonstrations, as well as the working out of examples, to such methods as are intelligible to those whose mathematical preparation would be unequal to the task of following similar demonstrations in which differential and integral calculus is employed. It is for this reason that it will, no doubt, be welcome to many who have, in the past, found the way to progress blocked when undertaking to handle alternating current calculation.

In the part relating to the relation between the electrical values in alternate current circuits, the author treats successively of the graphical representation of such values, the dependence of the difference of potential and of current strength between two points in a circuit, the energy relations of the current in different parts of the circuit, power factor, etc., and also of polyphase combinations.

The final chapter of this part will be found particularly useful to the student, as the author has here assumed a number of problems and worked them out in detail in order to show the manner in which the laws previously explained are applied in practice.

The second section of the book treats of the measurement of alternating values, including both the current strength, quantity, difference of potential, power and energy. Here we find short descriptions of the principles underlying the various measuring instruments employed in practice.

Intended merely as a students' manual, there is much, of course, which the author is barely permitted to touch on, but as he makes no pretension to an exhaustive treatment of the subject, it would not be fair to criticize him from that standpoint. We can recommend the book as giving, in a brief compass and in a simple manner, the main principles indicated by its title.

Notes From the Chicago Automobile Show.

A detailed account was given in these pages last week of the leading events at the Automobile Show in Chicago, accompanied by some notes on the exhibits. The affair was continued during last week in overflow fashion. Some further notes follow:

The Chicago Automobile Club kept open house to visiting devotees of the art at the Victoria Hotel.

An able corps of judges and experts were provided. The electrical expert employed by the *Inter Ocean* was William D. Ray. The other experts in charge of tests were Leland L. Summers, Cleveland; Prof. John E. Sweet, Syracuse, N. Y.; Prof. Henry Crew, Northwestern University; H. M. Brinckerhoff, assistant general manager Metropolitan Elevated Railroad; Prof. P. M. Chamberlain, Lewis Institute; Prof. C. V. Kerr, Armour Institute; R. H. Pierce, electrical and mechanical engineer.

A. B. Holson, inventor of the electric motor and gearing for automobile purposes, 42 River Street, Chicago, was at the exhibition. Mr. Holson states that several orders for apparatus of this type have been received. In this arrangement the motor is placed in the centre of a bevel gear and pinions on each end of the motor shaft mesh with the gear.

Exhibitors claimed that the carriage manufacturer who is going into the automobile business was very much in evidence. There were, however, also a number of carriage dealers on the lookout for agencies, and such were, of course, encouraged.

The General Electric Company exhibited a device known as the Lemp steering check, to be applied to the steering handle of automobiles and give steadiness in steering. It consisted of a dash-pot arranged in a small case surrounding the steering head.

A well-known agent of a well-known storage battery extensively used by exhibitors made a complaint that is rather unusual and illustrates very well the condition of that part of the industry that is really doing the business at the present time. "The trouble with me," said he, "is that I'm located in a rather uncomfortable place, right adjoining these two electric vehicle companies at this exhibition. One company is after me all the time to know why we don't ship it batteries

faster on the orders it has placed, and I'm hardly on speaking terms with the representatives of the other company since the show began, because they think we ought to let them have the batteries we have here on exhibition to fill the orders it has placed with us. Our troubles

FIG. I.—STANHOPE IN LADIES' RACE.

are with getting out orders fast enough rather than in selling batteries."

The National Automobile & Electric Company, of Indianapolis, made no exhibit, but was represented by L. S. Dow, president; A. C. Newby, vice-president, and Robert Martindale.

The natural and general call for historic and experimental machines brought out three vehicles—all electric, and all to present eyes ridiculously small and light in weight, considering the load they had to carry. One carriage seating four persons dos-a-dos had running gear about the weight of an ordinary two-seated farmer's buggy. The battery box was not large enough to be noticeable, and we presume the experimenters with the rig found it not large enough to be useful, either. It was equipped with a Perret laminated field motor, with double reduction gears to the axle. There were also two tricycles, seating two passengers, and fitted with solid-tire, direct-spoke bicycle wheels. These vehicles were the property of the Columbia Perambulator Company, and were built in 1890.

The runabout of the Hewitt-Lindstrom Motor Company proved the most speedy electric vehicle at the Chicago meet. Mr. Charles Lindstrom won the gold medal for the one-mile race for electric vehicles in 2:34. This was done with a power consumption of 80 amperes at 110 volts, against a strong wind on the homestretch. On the backstretch, with the wind, the power required was, of course, less. Mr. Lindstrom claims to have made a mile on a hard macadam road in 1:58, with energy consumption of 55 amperes at 112 volts. A battery of higher voltage than ordinary is used by Mr. Lindstrom, as will be seen from the figures just given. The runabout is a light vehicle, but has a heavy battery and two 2½-hp motors, so that the weight is brought up to 1850 lbs. Mr. Lindstrom says he is building a vehicle that will make 45 or 50 miles an hour, as he believes in the advertising value of speedy vehicles. The other vehicles exhibited at the Chicago show were types fully described and illustrated in the ELECTRICAL WORLD AND ENGINEER of July 14, 1900.

The stanhope exhibited by Strong & Rogers, of Cleveland, Ohio, and illustrated in Fig. 3, was awarded a diploma for the carriage most complete and handsome in detail. This stanhope weighs 1750 lbs., of which 700 lbs. are in batteries. Forty cells of Willard battery are used. In a neat case bound in goatskin, just behind the dashboard, are a combination ammeter and voltmeter, a cyclometer electrically operated from the front axle, and a clock. An incandescent lamp is placed just above this case to throw light down on it. The cushions are covered with fine goatskin. The steering and controller handles are pearl-trimmed with silver mount. The controller is provided with electric-brake contacts, so that the motion of throwing to "off," if continued, will put on the electric brake. The electric brake is simply the motor working through a resistance, and is intended for

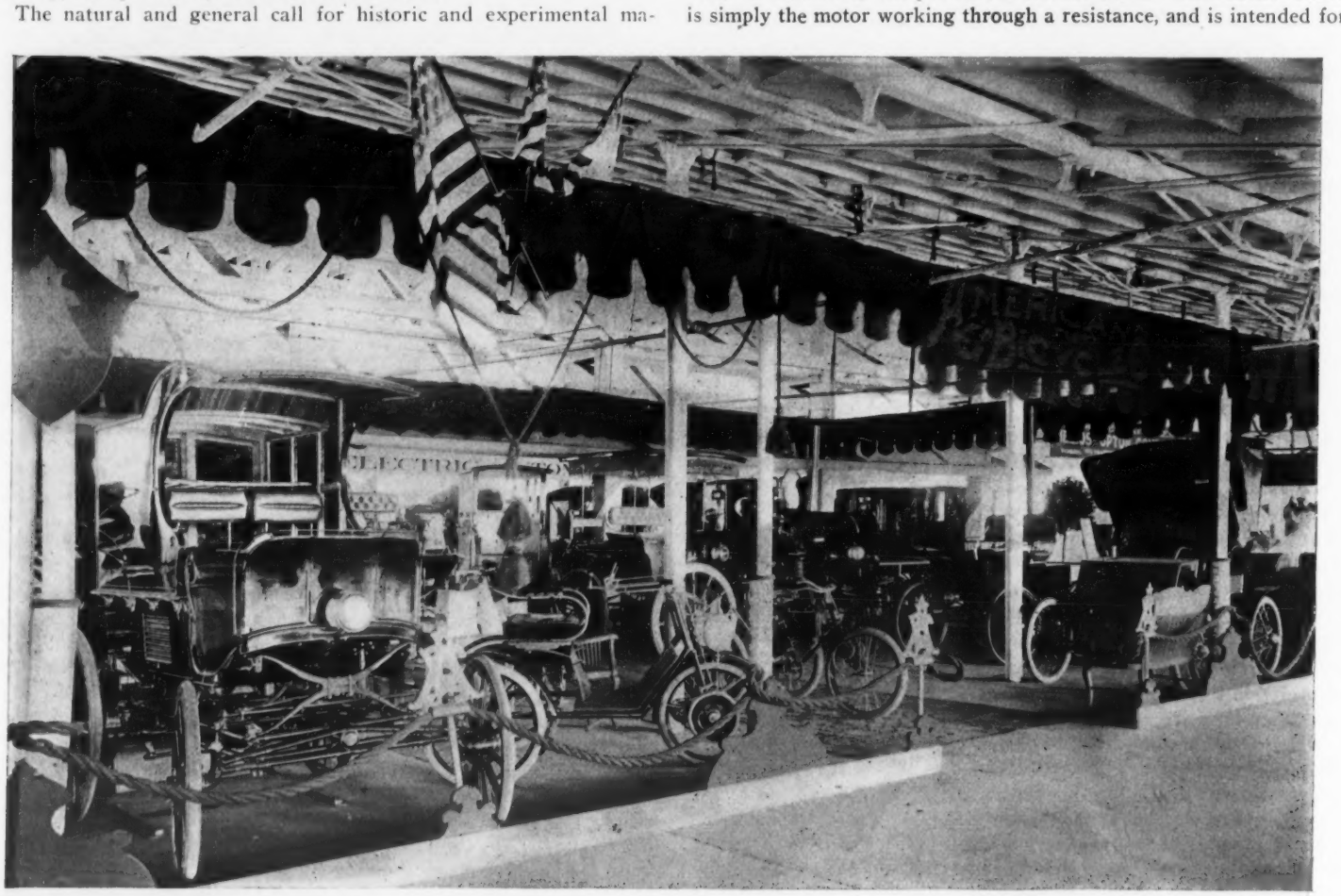


FIG. 2.—EXHIBITS AT THE CHICAGO AUTOMOBILE EXPOSITION.

ordinary service stops. A brake directly on the wheels can be worked by foot in case the pinion should break. Another foot lever throws the fields in parallel on any one of the three speeds afforded by the controller, thereby giving practically six speeds. The controller and brake rheostat are nickel-plated and put under the seat, but carefully

FIG. 3.—A NEW STANHOPE.

sealed off from the battery. The alarm bell is operated by a push buttom in the steering handle. A single motor is used, and the compensating gear put inside the large gear wheel. The vehicle made a very favorable impression.

FIG. 4.—FIRST PRIZE, PRIVATE OWNERS.

The electric vehicle races for Saturday, Monday and Tuesday of the meet resulted as follows: Five-mile manufacturers' race for electric vehicles—First prize, Hewitt-Lindstrom Motor Company; second prize, same company; time, 15:15 4-5. Special ladies' race, two miles—Miss M. A. Ryan, first; Miss Jeanette Lindstrom, second, both in Hewitt-Lindstrom vehicles; time, 6:43 2-5. Special race, one mile, electric vehicles of standard type—Alfred F. Leopold, first; Bruce Clark, second, both in Woods vehicles; time, 3:22 1-5. Two-mile merchant-delivery race, taken by Hewitt-Lindstrom Motor Company, no contestants. Five-mile ladies' race, free for all—Won by Miss Jeanette Lindstrom; time, 12:41 3-5.

The stanhope belonging to Mr. J. Wesley Allison, vice-president of the Woods Motor Vehicle Company, Chicago, which took the first prize in the parade for private owners as being the most elegant turnout, is illustrated herewith. It is a stanhope, with rear seat for footman. The main features in design are apparent from the cut, Fig. 4, and it is not necessary to describe it further in view of the now well-known character of this company's work.

The Hatch Electric Smelting Furnace.

Visitors at the convention of the Northwestern Electrical Association at Waupaca, Wis., last June, will recall the paper read by Mr. F. E. Hatch, of Green Bay, Wis., on electric smelting, and the small model exhibited by the author at that time. We are now enabled to present further and more detailed information as to this process of smelting and the practical results attained. The general principle of this smelting furnace is that of putting the raw ore in a closed cylinder with carbon bars heated by the current arranged around the lining of the cylinder, the cylinder being revolved and the carbon bars being cut in and out of circuit as the cylinder revolves, so that no current passes through the ore. Fig. 1 shows the furnace open with one end removed, and Fig. 2 shows the furnace with the end bolted on but with the hole in the centre open for charging and for the escape of gases while roasting preliminary to smelting. As can be seen in Fig. 1, the interior of the furnace has seven sets of carbon bars, each set of bars forming one side of a polygon, there being ten

FIG. 1.—ELECTRIC SMELTING FURNACE.

bars in each set. These ten bars in each set are both electrically and mechanically in parallel, and each set is electrically independent of the other sets. Only one set of carbon bars is connected in circuit at one time. The furnace is revolved on the rollers, seen in both Figs. 1 and 2, at the rate of one complete revolution every two minutes. The furnace is filled about one-third full of ore, and is revolved in the direction of the hands of a clock, as seen in Fig. 1. Projecting radially from the casing of the furnace are seven pairs of switch blades. Each pair is connected to the set of carbon bars nearest to it inside the furnace. As the furnace revolves clockwise the set of carbon bars which are in the position marked *L* in Fig. 1 are made live by the contact of the switch jaws of its set with the heavy stationary brushes mounted on the pillar at the right. As soon as the furnace revolves far enough so that the section just mentioned is cut out the next section above it is cut in, and so on—one section always being in circuit. A current is passed sufficient to bring the carbon up to a white heat.

The object of such a rotary arrangement of furnace is manifold. By the revolution of the drum the heat is more evenly distributed to the ore, and overheating and volatilization of some portions of the ore has been avoided. The passage of current through the ore itself

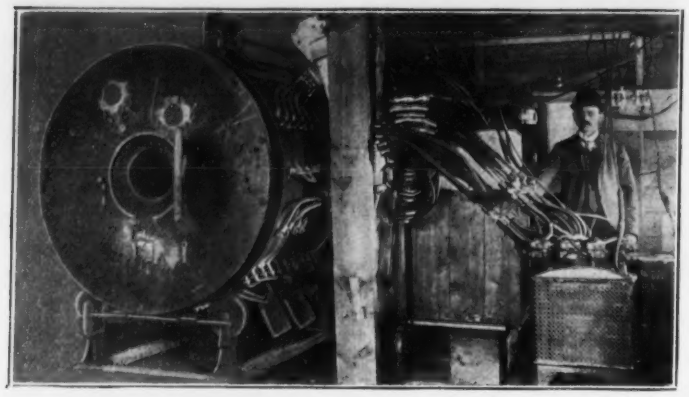


FIG. 2.—ELECTRIC SMELTING FURNACE.

is done away with, and by doing this a great deal of uncertainty is avoided as to the degree of heat. The ore is constantly being stirred, so that the action is more even on the mass. Many failures in electric furnace work, as well as poor results in ordinary smelting of lead and zinc ores, are due to inability to control the heat, and to the overheating of some parts of the mass without sufficient heat in the other parts. The present furnace has been successfully tried, Mr. Hatch says, on refractory lead and zinc ores, which require a furnace whose degree of heat can be regulated exactly, because the metals volatilize at a very low temperature, and overheating causes a loss of metal. In the furnace illustrated the carbons are 1 by 2 ins. in section, and contact is made with them by 1-in. copper bolts. They rest on the firebrick lining of the furnace, and are spaced 2 ins. apart, so that the ore falls down between them as well as on top of them, and has good opportunity to absorb heat. Channels are provided under the carbons in the firebrick lining for the smelted ore to run into, and from these it is drained occasionally. The case of the furnace is of boiler iron. The furnace is 4 ft. outside diameter and 3 ft. inside diameter, 5 ft. long outside and 4 ft. long inside.

The current taken is 600 amperes at 10 volts, or 60 kilowatts. The furnace will smelt 3 tons in 3 hours—2 hours being taken to roast the ore and 1 hour to smelt it. The roasting is done at a temperature of about 1000 degs. F. on refractory Galena lead ore tested, and it is then raised to 1500 degs. F. to smelt. With energy at 1 cent per kw-hour, Mr. Hatch figures that the cost per ton for smelting is $1.50 against $6 to $8 for smelting direct with coke in the ordinary way.

Mr. Hatch, who is the inventor of the process, and president of the Hatch Electric Smelting Company, of Green Bay, Wis., says that his company has contracts for forty furnaces, thirty of which are for a Canadian mining company which has investigated the apparatus.

A New Electric Igniter for Gas Engines.

The accompanying cuts illustrate a new form of sparking apparatus for internal-combustion engines. The device is as well adapted for use on automobiles and other small motive powers as upon large gas engines. The construction of the sparking plug is peculiar from the fact that both sides of the circuit are insulated. This double insulation greatly lessens the liability to short circuits, and will recommend the plug to those users of internal-combustion engines who have experienced the annoyance of a failure in the igniting apparatus. As seen in the illustration, the sparking occurs between two metal points which are set in the leading-in conductors. These points are made of solid platinum, and the rods into which they are set are made of steel. The insulation of the plug consists of a porcelain tube lined with asbestos, the steel leading-in rods fitting tightly within this lining and being held in place by a head at one end and lock nuts at the other. The tubes have a shoulder about midway which secures them in place, while the insulation is further increased by the introduction of mica washers at either end of the leading-in rods. In connection with the plug, a small induction coil of the vibrating contact type is used, a battery of four dry cells being more than sufficient to operate the apparatus. A novel arrangement of the cells is employed in this system. These cells are placed in a box, all connected in series. When the apparatus is started, four of the cells are connected to the primary of the induction coil, and as the cells fall off the connection can be easily changed so as to include five, six or more cells. The cells which are partly exhausted are thus used up. This arrangement is called the "New Standard Autogas Battery." The "New Standard" dry cell is used in connection with the device, and gives admirable results. This cell, which is one of the best known on the market, is made of a standard cylinder shape and size, the eight cells being enclosed in a box taking about one-half cubic foot of space. This type of battery is also set up with four cells, one-half the width of the larger size, and is called "Autogas No. 2."

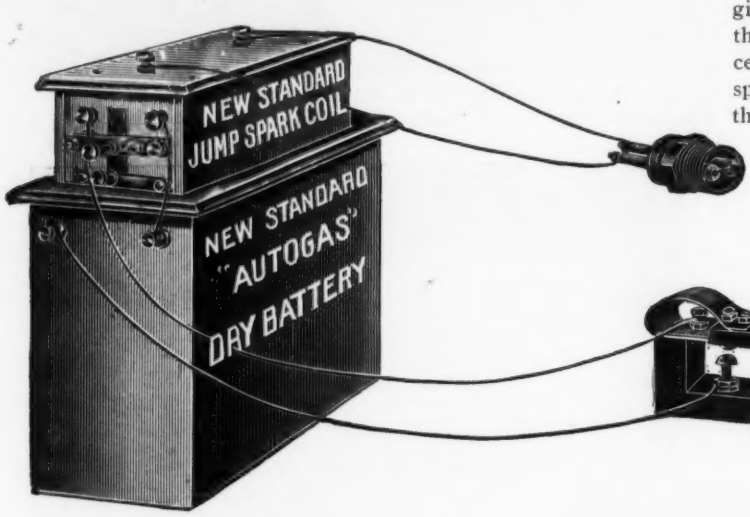


FIG. 1.—IGNITER OUTFIT.

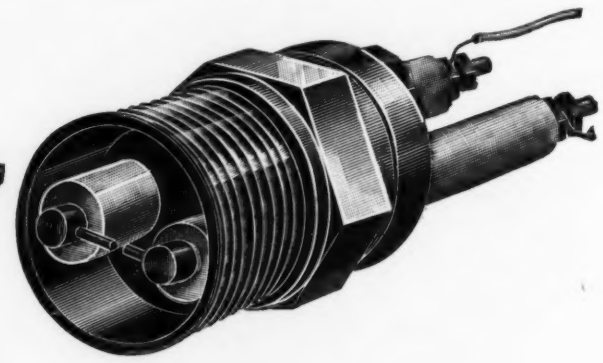


FIG. 2.—THE PLUG.

The circuit of the igniter is made by means of a fibre insulated key that is readily applied to any type of engine. It is operated by a cam attachment on the shaft of the engine, enabling the engineer to obtain the spark at any desired point of piston stroke. The system has been invented and perfected by William Roche, and the apparatus is made by him at his New York factory.

Demand for Telegraphic Appliances in Turkey.

Vice-Consul-General Albert sends from Constantinople, Sept. 5, 1900, a letter from Consul Norton, of Harput, in reference to the bids for supplies to be presented this month to the director of the Turkish postal and telegraphic service. The material is required in the construction of a new telegraph line.

One of the leading firms of Constantinople, says Mr. Norton, is desirous of securing quotations from a first-class American house to use in this competition. The telegraphic supplies which it has hitherto furnished the Ottoman authorities have been of English and German manufacture. The firm feels that the time is ripe for American material of the character in question to enter the Turkish market, with a fair prospect of success. Quotations should be received by Oct. 10, though a delay of a week or two will perhaps not prevent consideration, as the date for final reception of bids is frequently postponed a fortnight or more. The house requesting these figures is reliable, and there will be no delay in payment.

The articles required are:

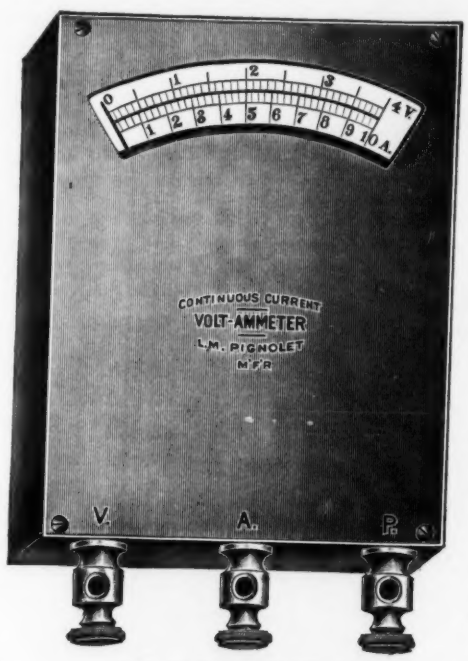
Galvanized iron wire of 5 millimeters (0.177 in.)	kilograms	†532,800
Galvanized iron wire of 4 millimeters (0.156 in.)	"	‡133,500
Large insulators, with iron accessories	pieces	40,725
Small insulators, with iron accessories	"	20,000
Large insulators, with iron accessories	"	2,225
Large insulators, with iron accessories	"	7,000
Posts, made after the Siemens pattern	number	1,000
Posts, made after the Siemens pattern	"	200

Drawings and full descriptions (in French) of these articles are filed for reference in the Bureau of Foreign Commerce, where they can be examined by interested parties.

Offers are to be sent to M. Edouard Zanni, Haratch Han, Stamboul, Constantinople (open mail, via London). Correspondence may be in English, but should be preferably in French. Prices should be expressed in francs (19.3 cents), and should be c. i. f. Constantinople, *i. e.*, packing, freight, insurance, and all charges (except customs dues) paid to Constantinople. Payment will be made by draft on London or Paris, immediately on receipt of goods. Quotations should be received at Constantinople by Oct. 10, or as soon thereafter as possible. In case of acceptance, a formal contract will be made at the United States consulate-general. The material will be furnished in several lots. Three months' notification will be given of the time for receiving each separate lot.

Pocket Volt-Ammeter.

The volt-ammeter shown in the accompanying illustration is one of a line of pocket instruments for testing storage and primary batteries, made by Louis M. Pignolet, 78 Cortlandt Street, New York City. These instruments are furnished in various ranges, and are useful not only for testing batteries, but for ascertaining the condition of telephone, annunciator and other battery circuits, and for locating faults, grounds, poor connections, etc. The instruments are of permanent magnet type and are very dead beat. Each is calibrated individually for horizontal position and its scale is made by hand. A mirror is provided to secure accuracy in making readings. The magnets are of special steel from one of the best foreign makers and are carefully treated to insure permanency. The instruments are constructed in a thorough manner, with jewel bearings and carefully ground and hardened steel pivots, no pains being spared to make the instruments durable and reliable. The case is handsomely polished and nickeled and is 3 ins. wide by 5 ins. long.



POCKET VOLT-AMMETER.

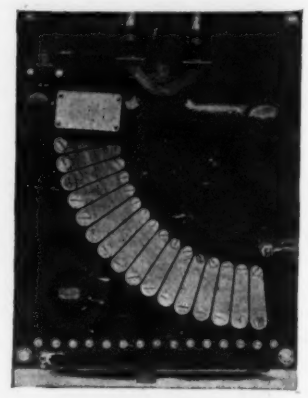
The Kansas City Special.

With regard to the train facilities from the East to the Kansas City convention of the American Street Railway Association, it is now announced that a special will be run from New York City which will be only one night on the road. It will leave New York at 10 a. m. on Sunday, Oct. 14, and will arrive at Kansas City at 9.30 p. m. on Monday, Oct. 15, making the trip in the fast time of 36 hours. It is now in order for all those who have not secured accommodation to do so at once. The party promises to be large and representative, and the convention will be one of the best in the long history of the association. The committee in charge would respectfully urge that all who take the train at New York, or stations on the New York Central & Hudson River Railroad, communicate with Milton C. Roach, general Eastern passenger agent, New York Central & Hudson River Railroad, 1216 Broadway, New York, stating exact accommodations required and from what point. The committee consists of H. H. Vreeland, chairman; Jas. H. McGraw, 120 Liberty Street, New York; Chas. W. Price, Park Row Building, New York; T. C. Martin, 120 Liberty Street, New York, for New York; Chas. S. Clark, 8 Oliver Street, for Boston.

†1,174,611 lbs. ‡294,314 lbs.

Ward Leonard Motor-Starting Rheostats Abroad.

The accompanying illustration shows one of seven rheostats furnished to D. Bruce Peebles & Co., Leith, Scotland, by the Ward Leonard Electric Company, Bronxville, N. Y. These rheostats are designed to start 100-hp 250-volt motors. German silver resistance is employed, and is attached to the back of the slate. The cast-iron box is then placed and sealed against the slate, and then filled with dry sand to absorb the heat generated in the resistance strip during the period of starting.



MOTOR STARTING RHEOSTAT.

The manufacturer calls attention to some of the principal features of the apparatus. They may be enumerated as follows: 1—All wearing contact parts are of cast brass and made removable from the face of the front without disturbing any of the internal connections. 2—In the position of short-circuit, the armature current has a path through two terminal lugs, thus avoiding the possibility of heating of the switch pivot or contacts while in normal running position. 3—This instrument will stand for fifteen seconds without injury, 100 per cent more current than the normal torque of the motor. 4—The resistance being entirely enclosed, the possibility of molten metal setting fire in case of a burn-out is entirely eliminated.

A New Shelby Lamp.

We illustrate herewith a new type or form of incandescent lamp which has been specially designed to produce a high candle-power in its lower hemisphere, with an even distribution from the horizontal to the vertical.

The filament is of a double oval coil. The bulb, with a flattened end, is arranged so that the light passes through it nearly at right angles. This new type of lamp is made by the Shelby Company in both the tipped and tipless form, the tipless bulb having a slight advantage over the tipped in the maintenance of candle-power from the horizontal to the vertical.

The following table is furnished us as showing accurate readings of the tipless bulb lamps in various positions, giving a comparison of two other forms of filament which are in general use:

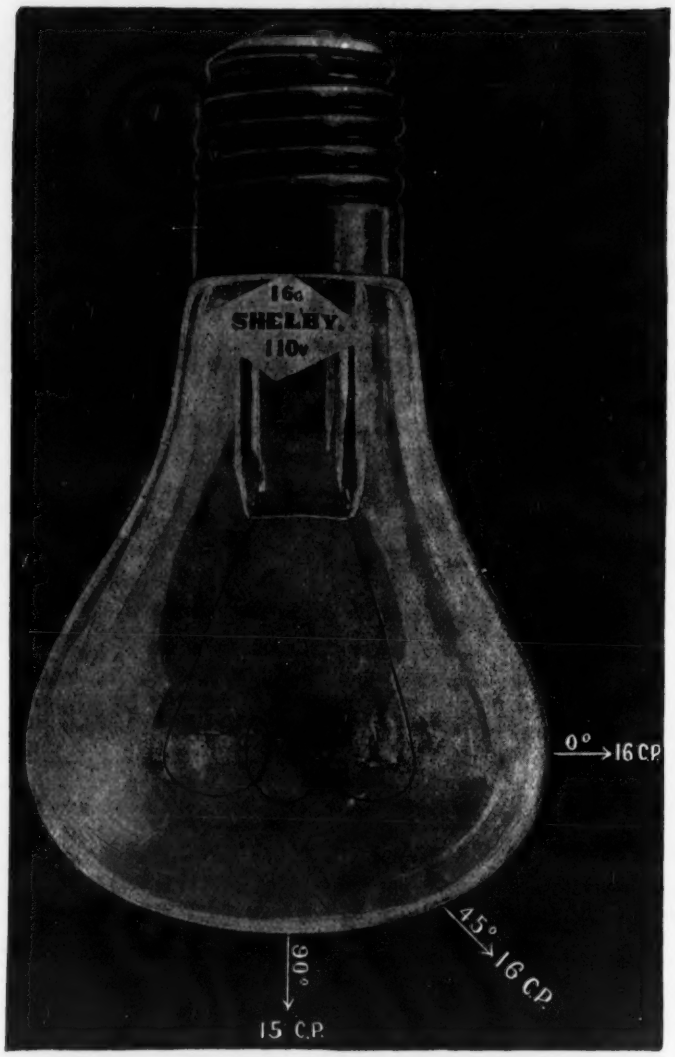
FORM OF LAMP.	180 Rev. Mean Horizontal.		Mean Spherical.		Mean Hemi-spherical.		Mean Axis, 45°.		Mean 30° from Vertical.		Mean Vertical. (90°).	
	C. P.	Effcy.	C. P.	Effcy.	C. P.	Effcy.	C. P.	Effcy.	C. P.	Effcy.	C. P.	Effcy.
Shelby coil (new type)	16	3.5	16.10	3.47	16.6	3.37	16.5	3.33	15.5	3.61	14.90	3.7
Anchored Filament...	16	3.5	13.75	4.14	14.6	3.83	11.7	4.78	8.7	6.43	7.05	7.9
Double Filament.....	16	3.5	13.20	4.92	14.0	4.00	12.0	4.66	7.9	7.08	4.8	11.6

The makers emphasize the efficiency of the different types at different angles, and say: "It is to be noted that efficiency, as well as candle-power, is the same in all lamps from horizontal ratings. The data in the table was arrived at by bringing each lamp to 16 candle-power when rotated at 180 r. p. m. on the horizontal, and at this volt-

age the measurements in the other directions were taken. Especial attention is called to the mean spherical candle-power, it being in the Shelby lamp higher than the mean horizontal. Attention is also called to the efficiency of each of the different forms of filaments 90 degs. below the horizontal or vertical. The double filament, it will be noted, has over three times the watts per candle-power as on the horizontal, and the anchored oval filament, over double, whereas the Shelby new type carbon increases only .2 watt per candle-power."

The Shelby Electric Company in designing and advertising the new lamp does not pretend to force vertical measurements as a standard measurement, but claims that heretofore sufficient attention or consideration has not been given to vertical distribution, and claims that the oval anchored filament lamp, as well as the double filament lamp, show designs for mean horizontal advantage only, the reason for this being that in the past specifications of various different associations have brought special stress upon such measurements.

In setting forth its ideas as to the value of vertical distribution, the Shelby Electric Company calls attention to the following facts: That light travels in direct rays; that lamps are almost invariably installed above the head of a standing or sitting person; or, in other words, above the horizontal line of vision, with the bases upward so that direct rays which fall upon an object beneath are from the lower



TIPLESS LAMP WITH NEW TYPE FILAMENT, WITH READINGS.

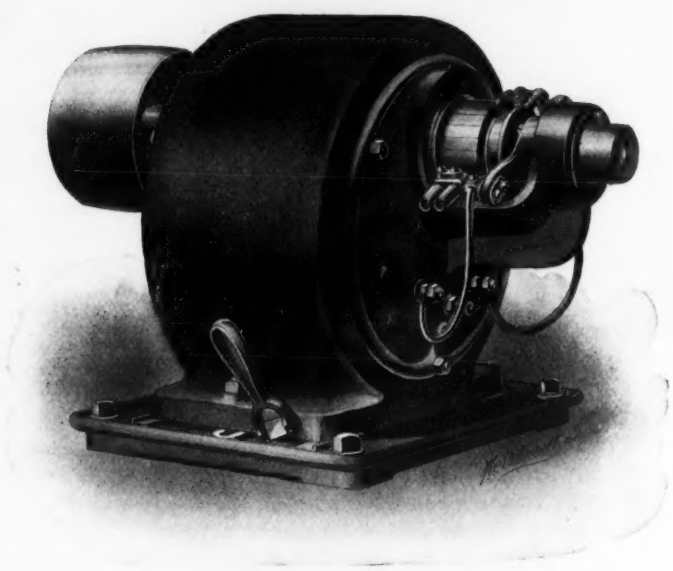
hemisphere of the lamp. In considering reflection, there are also a few facts to be taken into consideration. As shown in the above, Shelby lamps have as much light to reflect as any other type. Where walls and ceiling are depended upon as the reflecting surface, the absorption should be taken into consideration, also decrease of rays by the inverse square of the distance. It should also be remembered that the line of reflection is equal to the line of incidence. Whereas, the above points do not apply, to a certain extent, where good reflectors are used, it must be admitted by all light experts that reflected light, in many cases, is not the best. General illumination should also be considered, which the average reflector interferes with, causing shadows and dark spots, which is not good or practical illumination.

The Shelby Company also remarks: "The reflector lamp, introduced again recently in this country, meets with the same objection as the reflector—with many others added to it—regarding cost, etc. Since other light is necessary in connection with reflector lamps, for general illumination, we contend that illumination from the reflector lamp even at 1½ watts per candle-power in the direction in which the light is thrown, is extravagant illumination, as the so-called 34-cp reflector lamp costs the user 50 watts of current per hour to illuminate one spot, with an additional cost of other light for general illumination. If it were true that the direct rays used from an incandescent lamp are those emanating from the vertical or near it, why should not the efficiency of such rays which are used and which are the most useful, be considered?"

The Sterling Electric Company's Motors.

We herewith illustrate the ½-hp direct current motor manufactured by the Sterling Electric Motor Company, Dayton, Ohio. Instead of following the usual custom of developing simultaneously a number of sizes of motors, or, as commonly expressed, building a line of motors, this company has adopted the rather unusual idea of perfecting but one size of frame and building that size in large quantities, thus securing the many advantages which come with the rapid duplication of parts by a system of special tools, jigs and gauges. Among the advantages claimed for this system is the high degree of excellence in all the small details of workmanship and material, obtainable only by the closest personal direction of the work such as is impossible where a large number of sizes are being built in the same shop.

This frame when wound for ½ horse-power at the rather slow speed of 1200 r. p. m., is well suited for belting directly to line shafts or to many types of machines without the use of gears, countershafts or other speed-reducing devices. These motors are furnished wound for the following speeds—giving in each case power in proportion to the speed—250, 600, 900, 1200, 1500, 2000 r. p. m. They are wound for any of the standard voltages. Another novel feature of the company's plans is to carry in stock armatures and fields coils for all speeds and voltages, which they furnish when required, to any cus-



STERLING MOTOR.

tomer in exchange for those sent with the motor when sold, enabling the customer to change either the voltage speed or capacity of his motor at any time at a merely nominal cost.

The company was guided in the selection of size by the fact that a very large percentage of machines and tools of all kinds which are now being equipped for electric driving require motors within the capacity both in speed and power of the frame chosen. It is also claimed that a close study of the subject of direct driving enables the makers to adapt their motor to any machine within its capacity in the most efficient manner by furnishing their motors either shunt, compound or series wound and with or without special regulators, as the conditions of the case may demand.

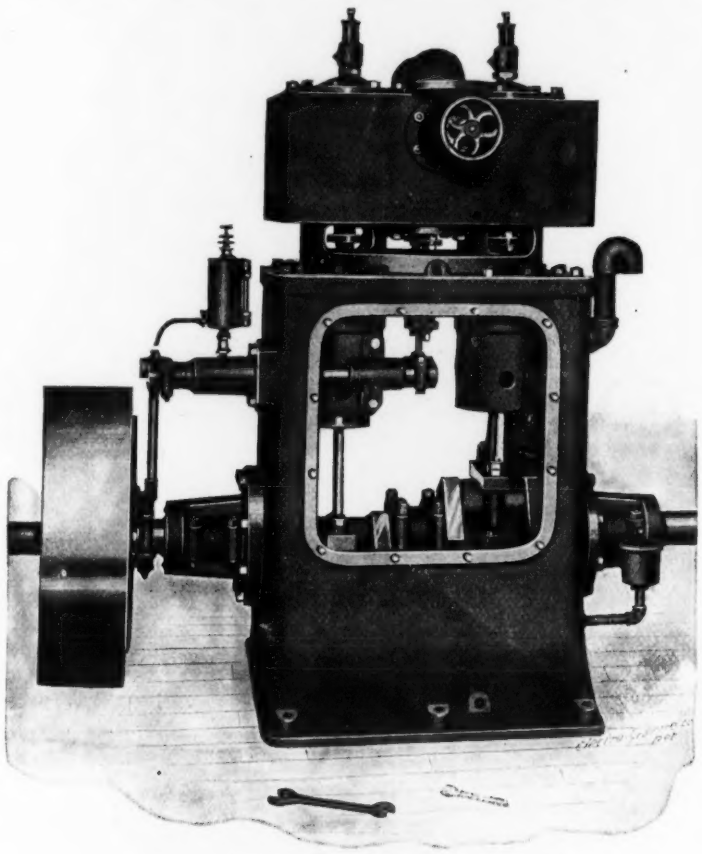
The most striking feature of the design is its extreme simplicity,

there being but one field core, which is set into the lower part of the cast-iron yoke; the upper pole piece is formed in the yoke ring. The armature is machine wound directly on the core in overhanging slots, the wire being wound directly from the wiremaker's spool without hand labor. The wire is confined in the slots by strips of bamboo driven in endwise after the winding is complete; this novel method is said to give an extremely handsome finish to the armature, aside from insuring great safety.

The bearings are phosphor bronze sleeves held in cast-iron boxes which contain the usual oil well and rings. These cast boxes swing on a ball-shaped seat in the motor heads, and are thus self-aligning. When it is desired to mount the motor on a side wall or ceiling, or in any but a vertical position, the boxes may be turned in these seats so as to bring the oil wells at the bottom, and no other adjustment is necessary. The motor heads are centred and retained in position in the frame of motor by three stud bolts, and serve to close entirely the motor and protect the coil and armature. The motors are mounted on sliding bases, the edges of which are turned up to form an oil pan which is designed to catch any oil which might run over from filling the oil wells. The company reports that its business plan and machines have met with favor which surpasses its expectations.

A "Cornish Cycle" Engine.

The Fuller Company of Detroit, Mich., has designed a double-acting engine combining the advantages of both double and single acting types. This engine is set vertical and has the usual cylinder, piston, rod, crosshead, guides, connection rod and double cranks of the double-acting engine, but the operation of the steam on the piston is entirely different, the so-called "Cornish cycle" being used, and it is the only engine of the type made in America for high speed.



"CORNISH CYCLE" ENGINE.

The high-pressure steam is admitted to the top of the cylinder only. After having done its work there, it is transferred below the piston by the valve establishing equilibrium between both ends of the cylinder, and closing at the proper point on the up-stroke of the piston, to prevent any tendency of connections leaving the crank-pin. On the down stroke the steam is exhausted to the atmosphere, or to a condenser, where the vacuum forming under the piston removes the back pressure. Thus the piston at all times, whether working condensing or non-condensing, exerts a downward pressure on the crank pin, which enables the engine to run noiselessly at high speed.

The stuffing box of the piston rod is in the open space between cylinder and crank case, and being on the low pressure side of the cylinder, can be quite slack and free from friction. The engine is of the enclosed type, with splash lubrication, which offers so many advantages at high speed. The Rites single-weight governor is fitted and will regulate within 2 per cent. The engine is built of the best material. It is made with single or double cylinders, compounded if desired, and is adapted to any service where a noiselessly, high-speed engine is required. These engines have large doors in the crank case, both front and back, and when these are removed, all parts are as accessible as the parts of any ordinary open engine. They are especially suitable for hard work in dirty and dusty places, where ordinary engines would suffer in their moving parts from such dirt and dust.

Owing to the absence of knock, it is said, the bearings and brasses wear a much longer time, never requiring "taking up" or adjusting, the engine working noiselessly until brasses are worn through, and can then be removed and replaced at as low a cost as those of any double-acting engine.

Portable Fire Alarm Apparatus.

THE recent sudden and disastrous fires covering large areas, such as that at the North German Lloyd piers in Hoboken, suggest very emphatically the necessity of using a fire alarm system that should be at once more flexible and sensitive than those heretofore in vogue. The subject is so important as to lose its commercial aspects when viewed aright, and yet to enlist prompt support for improvements in that specific direction.

Fig. 1 represents the Montauk portable fire detector, which consists of a reel of Montauk fire-detecting wire, a 6-in. gong and the necessary dry battery all mounted, as shown, in a suitable wooden case, connected and ready for "business."

Montauk wire, as has often been explained, is virtually two wires under one cover. The central wire, forming one side of a circuit, has a thin coating of fusible metal; over this is an insulating cover, wound spirally around which are about a dozen fine wires; these form the other side of the circuit; an outer insulating wrapper protects the whole. Montauk wire looks like any other insulated wire, and, being flexible, can easily be led around and over piles of inflammable material, and, when so distributed and properly connected, serves as a fire protection unexcelled.

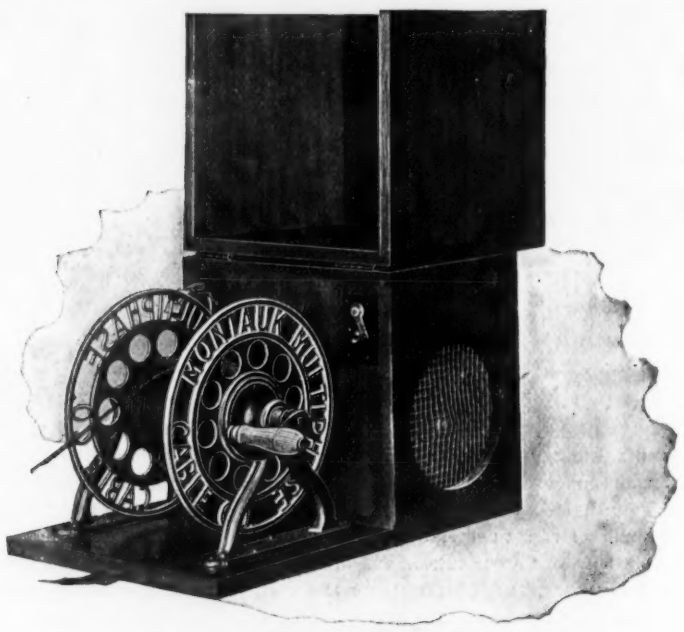


FIG. 1.—PORTABLE FIRE DETECTOR.

A few seconds after heat equivalent to that of a match comes into close proximity to a strand of Montauk wire, the soft metal coating on the central wire fuses, and, according to a natural law, expands; having no room for expansion otherwise, it forces itself through the intermediate insulation and necessarily touches some one or more of the fine wires, thus establishing a connection, or "short circuit." It is, therefore, self-evident that unreeling 100 ft. of fire-detecting wire is similar to distributing many times that number of thermostats.

"Distributing thermostats" down on the floor and around and over inflammable material is a decidedly new departure, and commends itself to those who are familiar with the service afforded by the ordinary thermostat located on the ceiling. A fire-detecting wire in the immediate vicinity of flame will give an alarm considerably before the temperature of the room is raised to the thermostat alarm-point. For exposed and similar locations the advantage of a device, such as the Montauk portable fire detector, is considerable.

If goods are placed in a room or building and it is desired to protect them from fire or have an immediate alarm given if a fire should occur near or in the goods, the Montauk fusible detection wire is unwound from the spool and freely spread and disposed about, around and over the goods or about the room near the goods as much as it is desired to fully protect the same at all points. The circuit is open in the wire and in the spool, and so long as there is no fire it will remain open, indicating everything is all right; but the instant undue or dangerous heat occurs near to the Montauk wire, which would tend to and might produce a flame or fire, the fusible coating is expanded, closing the circuit and instantly sounding the bell or alarm.

For locations where protection more complete than that afforded by a single portable set is desired, there has been designed a "combination set." This consists of several reels, battery and gong mounted and connected together into one "portable system." If desired, connection may be made to an annunciator, each drop representing one of the reels.

This comprehensive arrangement can cover and protect an immense area. Suppose a cargo of cotton or other inflammable material is of necessity stored upon a dock, and fire protection is desired for the night. A "combination set" can be located at some point of vantage and its sensitive strands or "fire nerves" distributed liberally all through the merchandise in a moment's time; if fire breaks out, or by any means dangerous heat is generated, warning will be immediate.

The permanent reel is designed, as its name implies, to be fastened to the interior walls or other support of buildings or docks, etc. The actual terminals may be connected to trip an annunciator drop or ring a local gong, or both. Further connections can easily be made so that fire warning can be simultaneously announced to the city or other main fire department.

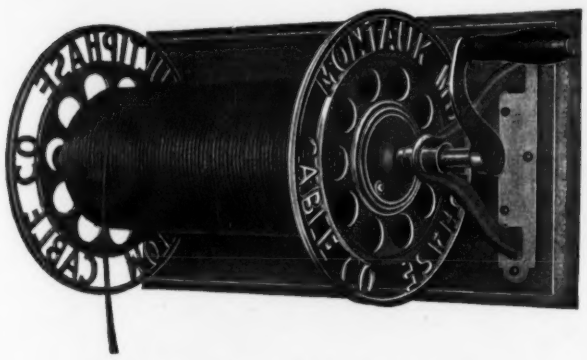


FIG. 2.—REEL OF FIRE DETECTING WIRE.

If the reel is connected to an annunciator drop, many reels may be placed on one system, and the annunciator, although in the office or some other place distant from the farthest strand of wire, will give not only the announcement of fire's outbreak, but its location. These reels are made to hold from 300 ft. to 1000 ft. of detecting wire.

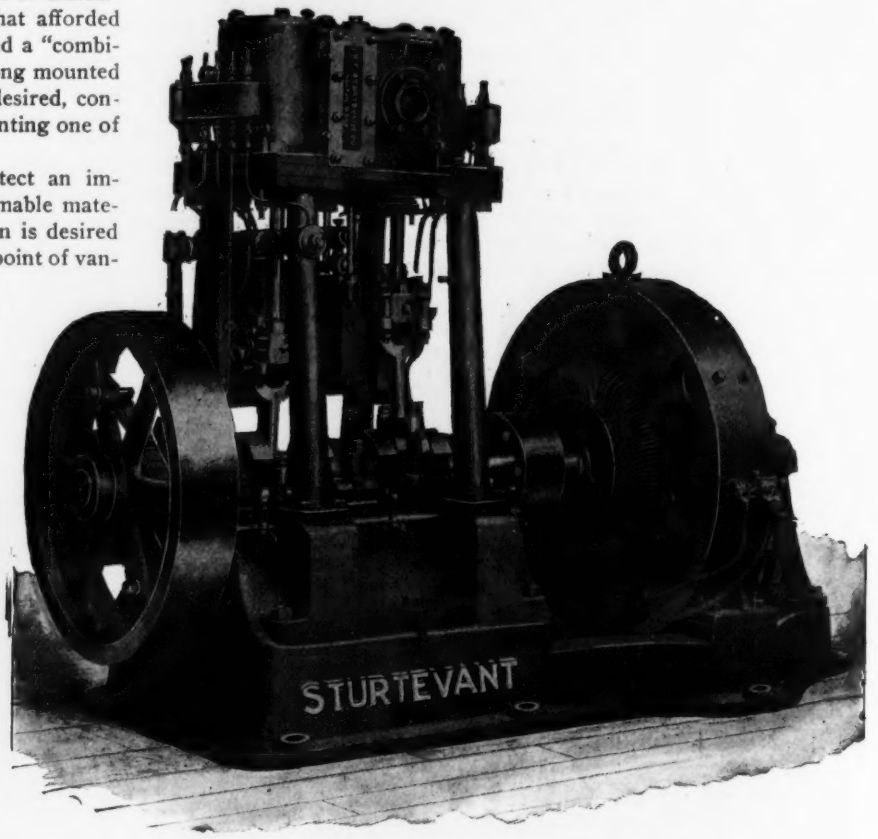
It must be understood that the use of such detecting wire, as above described, is only one of its many utilities. Montauk wire is a service wire, and is a convenient design of duplex conductor for all kinds of low potential service work. Its decided and striking peculiarity, long since familiar to the electrical trade, is that every infinitesimal point is a thermostat. The wire may have been doing ordinary work for years, but a few seconds after heat equivalent to that of a match reaches it, the resulting short-circuit will, through the medium of bell or annunciator drop, call out the alarm.

The Montauk Multiphase Cable Company, which controls the pattents and manufactures the various Montauk fire-detective devices, will be pleased to furnish those interested with full and complete descriptive matter and samples of the wire. Its office is in the American Surety Building, 100 Broadway, New York.

A Marine Generating Set.

In the design of the generating set illustrated herewith the features of compactness, accessibility, economy and stability, with consequent lightness of parts, and ability to maintain an excessively high rate of speed during a long period, have been most carefully developed. The engine is two-cylindered, the cylinders having their axes parallel, and being contained within the same casting. The diameter is very large relatively to the stroke, the size represented here being 9-in. cylinders with 5½-in. stroke. The valves, which are of the piston type, are two in number, placed in spandrels between the cylinders, and actuated from a yoke below, which in turn receives its motion through a rocker arm from the eccentric.

The valves, which operate in unison, are so designed that steam is coincidentally admitted to the top of one cylinder and the bottom of the other. The motion of the pistons is transmitted through large piston rods to slipper crossheads, and thence through marine-type connecting rods to the double crank below.



MARINE GENERATING SET.

The crank pins are set at an angle of 180 degs., so that the vertical motion is balanced, one crank moving upward as the other moves downward. This feature is instrumental in the securing of a high rotative speed.

The cylinders are supported upon four heavy columns, as shown, the rear columns supporting the guides for the crossheads, and all being securely bolted at the bottom to the very substantial bed casting. This bed carries three main journal bearings, brass bushed in their lower halves, and provided with continuous oiling devices in connection with oil receivers beneath. The interior of the bed forms a basin, which collects all drip from water or oil.

The regulator is of special construction, and arranged to operate the valve in such a manner as to regulate the point of cut-off for all loads. It is exceedingly powerful, although sensitive to very slight changes in speed. The connecting rods and crossheads are of forged steel, the cylinders are thoroughly lagged, and an oil tank is mounted upon each end of the cylinder casting, and provided with individual sight feed oilers, and connections to the various bearings.

The generator, the armature of which is coupled to the engine shaft, is carried upon a continuation of the engine base, and is of the six-pole type with outboard ring oiler bearing. Its capacity is

40 kilowatts at 425 r. p. m. (the speed of the engine). The field ring is of cast-steel. The cores are of wrought-iron with cast-iron shoes. The armature is built upon a spider, and is arranged for thorough ventilation through internal ducts, extending out through the armature windings. The armature in operation acts as a blower, and causes the passage of air through these ducts. The series winding of the field coils is of flat copper ribbon, and the shunt winding is of wire. Both windings are placed on the pole entirely independent of each other, and either may readily be removed. Their design is such as to permit of free circulation of air upon all sides.

The generator is designed for sparkless operation under all changes of load from no load to 25 per cent overload, with a limit of temperature to rise to 90 degs. F. after a full-load run of ten hours. This set was designed by the B. F. Sturtevant Company, Boston, Mass., and is one of a considerable number of types which are now being manufactured by this company.

A New Ammeter.

The accompanying Fig. 2 shows a new ammeter made by Kendrick & Davis, Lebanon, N. H., of the permanent magnet and helix type. It is hand-calibrated, and is said to be very accurate for a low-priced instrument. The case is made of hard wood nicely finished. The magnet is of special magnet steel and the indicator needle is aluminum. The pivots are made of hardened steel and hang in brass bearings. A leveling screw is provided at the side so that the needle may be brought to zero on an uneven table. The binding posts are of an improved type and are not liable to cause contact. These instruments are calibrated from 0 to 14 and are made both in ammeters and voltmeters.

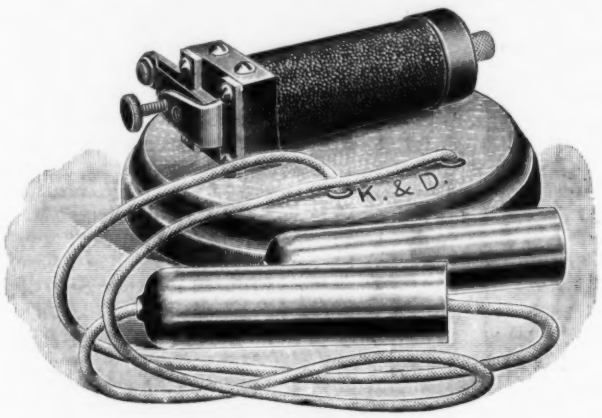


FIG. 1.—MEDICAL COIL.

Fig. 1 shows a medical coil just being put on the market by the same company as above. One of the excellent features of this coil is its close regulation. The current at the handles varies from an absolutely imperceptible to a very strong current. The coil and the vibrator parts are self-contained, and the contacts are pure silver. The spool heads are finished in bright enamel over wood, and all metal parts are nickel-plated. It is mounted on a round, nicely polished cherry base.

FIG. 2.—AMMETER.

New Direct-Connected Multipolar Machines.

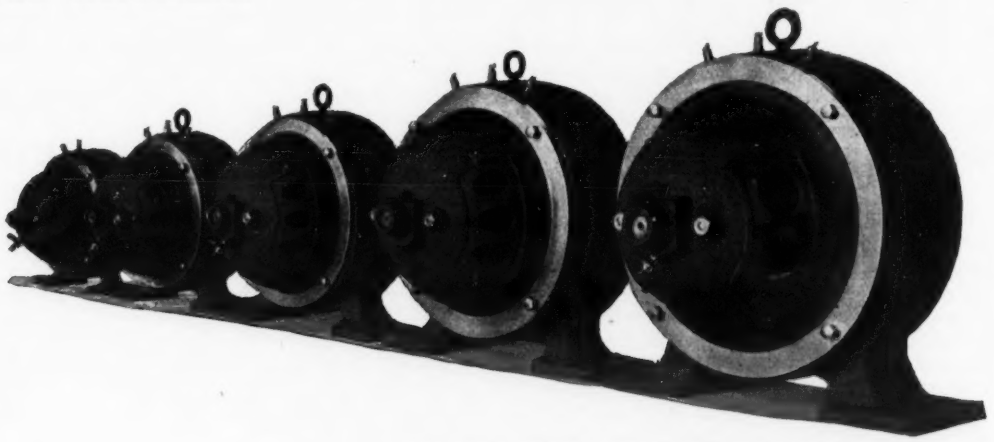
We note the advent of a new manufacturing concern in the electrical machinery field in the Three Rivers Electric Company, of Three Rivers, Mich., which has recently commenced the manufacture of direct-connected, multipolar motors and dynamos and other special apparatus. This firm has for the past year and a half been arranging for the manufacture of motors and dynamos, having secured the services of Mr. George F. Card, who was formerly with the Card Electric Company, of Mansfield, and who is by no means a novice in the manufacture of electrical machinery. Their factory buildings are located at Three Rivers, Mich., at the intersection of the Lake Shore & Michigan Southern and the Michigan Central railroads, thus having loading facilities on both roads. The main building is of brick, and all of them are splendidly lighted, heated and ventilated, and are fitted with the most approved sanitary arrangement throughout. It has in connection with the plant a brass foundry which has all the latest appliances for the economical and speedy handling of brass, bronze, copper and aluminum castings, and the equipment throughout is of the most modern construction, tools and appliances being purchased for the peculiar work of this nature.

The machines that it is putting out it claims are the result of years of experience, and the work is done by competent, skilled hands. The selling department, outside of the State of Michigan, will be in the hands of the well-known house of Fairbanks, Morse & Company, and their branch houses are located in various points of the West. All correspondence outside of Michigan should be directed to these people.

Onondaga Enclosed Power Motors.

Five sizes of type E direct current enclosed motors, made by the Onondaga Dynamo Company, Syracuse, N. Y., are shown in the accompanying illustration. This type of machine was developed to meet the demand for an efficient, compact, slow or high speed motor, protected from dust, and adapted to service in any location—on floor, side wall or ceiling.

The bearings, it will be noticed, are held in place by end shields or hoods, which protect the armature and fields. At the commutator end of the hood, two doors are provided which afford easy access to the commutator and brushes. The armature, fields and commutator are built up in the best manner, and the brush holder is so designed that a uniform bearing surface is obtained with a minimum pressure, thereby causing the smallest amount of friction upon the commutator, and, consequently, the mimimum amount of heat. The brushes, which are made of carbon, may be removed while the machine is in operation.



FIVE SIZES DIRECT CURRENT ENCLOSED MOTORS.

These machines are so constructed that the load may change from zero to full load without causing sparking at the brushes. Each motor is provided with a fireproof rheostat and automatic release fireproof starting box. These machines are made for high speeds and medium speeds, on 110, 120 and 500 volts, and range in horse-power for high speed machines from ½ to 16 horse-power, and in the medium speed from ¾ to 10 horse-power.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money on call closed at 2 per cent nominal. Time money was firm throughout the week and the demand was active. The rates at the close were 4½ per cent for sixty days to four months, and 5 per cent for five to six months. Rates for mercantile paper, 4¾@5 per cent for indorsed bills receivable; 5@5½ per cent for first-class single names. The demand was met, but the supply was not large. The stock market was inclined to break early in the week under the influence of the coal strike. Declines were scored throughout the general list accompanied by liquidation and short selling on the part of traders. On Thursday there was a sharp rally in prices, caused mainly by reports of a prospective settlement of the strike and a more favorable political outlook as viewed from the Wall Street standpoint. Electric stocks responded in unison with those of the general list, declining with them and subsequently rallying on the strength of the influences above noted. All of the principal electric stocks closed the week with fractional advances over the week previous, the quotations for General Electric and Metropolitan being ex-dividend. Outside securities: The declining market noted week before last continued during the early part of last week, and several material losses were recorded. Later in the week, however, the market became firmer, and there were some substantial recoveries of previous losses. Electrics were included in these movements, but some of them regained part of their earlier losses. In no case, however, was there any active trading. Electric Boat preferred, after selling as low as 20½, recovered about 7 points, and ended the week with a net gain of 5 points. Electric Vehicle sold as high as 19½, and gained 3 points net. The following are the closing quotations of electric stocks in the four cities named:

NEW YORK.

	Sept. 22.	Sept. 29.		Sept. 22.	Sept. 29.
Gen. Elec.	135	134⅞	Elec. Veh.	17	17
Bklyn Rap. Tran.	50	50¾	Elec. Veh., pfd.	*50	*50
Met. St. Ry.	146½	*147⅞	Gen. Car.	5	4⅝
Am. Tel. & C.	87	..	Ill. Elec. Veh. Tran.	1⅛	1⅛
West. Un. Tel.	78½	78⅞	N. Y. Elec. Veh. Tran.	7	6½
Am. Dist. Tel.	25	..	N. E. Elec. Veh. Tr.	3	3
Com. Cable.	160	..	Tel., Tel. & Co. of Am.	6	5½
Elec. Boat.	13	14	Hud. Riv. Tel.	116	116
Elec. Boat, pfd.	30	22	N. Y. & N. J. Tel.	160	160

BOSTON.

	Sept. 22.	Sept. 29.		Sept. 22.	Sept. 29.
New Eng. Tel.	..	..	Erie Tel.	97	..
Mex. Tel.	..	..	Gen. Elec., pfd.	..	..
Westing. Elec.	..	..	Am. Tel. & Tel.	138½	137
Westing. Elec., pfd.	..	..	Ed. Elec. Lt.	..	..

PHILADELPHIA.

	Sept. 22.	Sept. 29.		Sept. 22.	Sept. 29.
Elec. Stor. Bat.	61	57	Phil. Elec.	2½	2¼
Elec. Stor. Bat., pfd.	..	61	Pa. Elec. Veh.	..	..
Elec. Co. of Am.	8⅛	8½	Pa. Elec. Veh., pfd.	..	..
Gen. Elec. Auto.	¼	¼	Am. Rys.	..	27½

CHICAGO.

	Sept. 29.		Sept. 29.
Chicago Edison	135	Chicago Telep. Co.	200
Chic. City Ry.	242	Union Traction	10¾
Nat'l Carbon	16	Union Traction, pfd.	46½
Nat'l Carbon, pfd.	79		

*Asked.

DECLINE IN BELL STOCK.—Discussing the long decline in Bell Telephone stock, the Boston News Bureau says: "We are asked why the American Telephone & Telegraph Company stock, paying 7½ per cent per annum, sells below 140. The only reason we can find at present for the low price of American Telephone shares is that the company in changing its name the last time dropped the word 'Bell.' The words 'Telephone' and 'American' attach to a great many schemes of doubtful return. There are telephone and telegraph schemes almost without number whose chief asset is hope, but only one concern has carried the name, Bell Telephone, and these two words have been synonyms of the greatest success. The American Telephone & Telegraph Company was organized years ago as a sub-company of the American Bell Telephone Company, and without having any quotation of its shares, the American Bell Telephone Company suddenly found itself called upon to metamorphose into its sub-company with the necessary result that the magic name Bell Telephone was lost. This name ought to be worth about $25 per share upon a stock that formerly sold as high as $380 per share when there was only one-half the amount of stock at present outstanding. Investors must get used to a new name, and must see it quoted over a considerable period of time, and must see the earnings as well as the dividends set against its name before such new name can have the drawing power which the old name had. The history of every reorganization where the name is materially changed is that public interest both of an investment and speculative nature is lost for a considerable period of time with the general result of declining quotations."

DIVIDENDS.—The Mexican Telegraph Company has declared a quarterly dividend of 2½ per cent, payable Oct. 13. The Ceneral & South American Telegraph Company has declared a dividend of ½ per cent, payable Oct. 6. The Erie Telegraph & Telephone Company has declared a quarterly dividend of 1¼ per cent, payable Oct. 8. The Wisconsin Telephone Company has declared a quarterly dividend of 1¾ per cent, payable Oct. 8. The Michigan Telephone Company has declared a quarterly dividend of 1¼ per cent, payable Oct. 8. The New York & New Jersey Telephone Company has declared a quarterly dividend of 1½ per cent, payable Oct. 15. The Westinghouse Machine Company has declared a quarterly dividend of 1½ per cent on preferred and 1½ on common stock, payable Oct. 10. The Otis Elevator Company has declared a quarterly dividend of 1½ per cent on preferred, payable Oct. 13. The Findlay (Ohio) Street Railway Company has declared a quarterly dividend of ¾ per cent, payable Oct. 10. The American Telephone & Telegraph Company has declared a regular quarterly dividend of 1½ per cent, payable Oct. 15. The Hall Signal Company has declared a quarterly dividend of 1 per cent on the common stock.

PHILADELPHIA BELL TELEPHONE.—The Bell Telephone Company of Philadelphia's new $1,000,000 issue of stock to present stockholders will be paid for, in three instalments, Nov. 19, Jan. 18 and March 18. The proceeds of this issue as well as of the first $1,000,000 (completing the $2,000,000 authorized by the stockholders in March) are being put into improvements and extensions. An official says: "The plan is to provide a plant which will serve not only the 14,000 present subscribers but 26,000 more (a total of 40,000), which it is hoped to gain in a few years. The company's gross receipts have materially increased over those of a year ago, but the net earnings, owing to the expenditures referred to, have been less than last year. We have, however, been earning enough to pay the 8 per cent dividend regularly, and a little more beside."

CONSOLIDATION IN MONTGOMERY.—All of the street railways and electric light companies in Montgomery, Ala., have been consolidated, the deal involving a combination of over $3,000,000 of capital. The combination includes the Montgomery Light & Power Company, representing a million and a half invested; the Montgomery Street Railway Company and the water power companies of Montgomery, a million and a quarter. The bonded indebtedness of the combination will be $2,100,000.

TELEGRAPH-TELEPHONE.—Mr. John W. Mackay, president of the Postal Telegraph-Commercial Cable Company, denies the story that his company is to enter into a trust with the Bell Telephone and Western Union. He stated emphatically that he knew nothing of the deal save what he had read in the papers, and believed the report was entirely without foundation.

Commercial Intelligence.

THE WEEK IN TRADE.—In reviewing the trade conditions throughout the country, *Bradstreet's* says that the close of the month of September shows a rather better outlook in the industrial world than was apparent a week or ten days previous. The settlement of the amalgamated wage scale in the West has already resulted in the starting up of some important mills. An encouraging feature of the iron and steel situation is the number and character of foreign inquiries. The demand for structural material continues steady and prices are firm. There is a general satisfactory activity in distributive trade. At the larger centres, particularly in the East, the undertone appears to be conservative. Business in the territory tributary to Chicago is reported to be feeling the effects of the agitation in politics, and in the Northwest there is less snap in trade conditions. Trade is satisfactory on the Pacific Coast. The failures in business for the week numbered 169, as against 183 the week previous, and 129 the same week in 1899. The copper market is quiet and unchanged, the ruling quotations being 16¾@16⅞c. for Lake Superior ingot; 16⅝c. for electrolytic and casting stock. It is stated that the domestic business in copper has fallen off considerably in the last two weeks, and that the exports are also similarly affected, only 7800 tons having been exported so far in September. In the New York machinery market, nothing of a special character transpired during the week; the general conditions are normal and the export trade is reported as quiet.

AMERICAN APPARATUS IN ENGLAND.—The following comment from a recent issue of *Fielden's Magazine* would indicate that the frequent preference for American street railway material is not always approved in England: "Southend-on-Sea is in want, it seems, of certain truck and car equipment for an electric trolley line, and only a few weeks ago visitors to the Agricultural Hall in London had an opportunity of seeing that such material is obtainable in our country, at reasonable prices, from industrial concerns that are exclusively British, and which spend the money they receive in our own country, employing British brain and muscle and encouraging British manufactures. What more natural, therefore, than to offer to such firms an opportunity of competing for the supply of the material required by the above-named corporation? This is so obvious that the local authorities of Southend-on-Sea realized that, by the merest rules of decency, they were obliged to ask these firms for tenders. It is one of our best known engineering firms whom we have to thank for handing over to us the document that was sent to them. On page one of the specifications, where the corporation describes what motors are wanted, we read as follows: 'The equipment under this section must consist of the following apparatus and materials, inclusive of supply, delivery and fixing. Each car to be supplied with: Two Thomson-Houston G. E. 52 railway motors on ten double-deck cars; two Thomson-Houston G. E. 58 railway motors on two bogie cars; two Thomson-Houston G. E. 800 railway motors on two single-deck cars,' etc. Why any British firm, excepting the British Thomson-Houston Company, should be invited to furnish the above-named motors is an absolute mystery, for the choice of Thomson-Houston manufactures in preference to others has obviously been made beforehand, and naturally these manufactures cannot be supplied cheaper by anybody else than the Thomson-Houston Company. Since, however, there is a British Thomson-Houston Company in existence, our readers will perhaps say that the selection, although it indicates favoritism, is at least not necessarily unpatriotic. Granted, so far; but let them read what follows on page two: 'The motors shall be of the General Electric of America's manufacture.' Here, then, we see that not the British Thomson-Houston Company is intended, but it is stated in so many words that no British makers need apply, not even such as are called British by courtesy, and that the goods must be of American manufacture. Again on page three, for instance, we find, with reference to 'Controllers,' that these also 'are to be of the series parallel type of the General Electric of U. S. A.' On page five, with regard to 'Trucks,' occurs the following stipulation: 'The twelve four-wheeled trucks shall be of Brill (21-E. type, with solid forged frame) or Peckham extension manufacture,' i. e., American, and 'the four bogie trucks are to be Brill or Peckham maximum traction trucks.' On the next page, finally, we read that 'four bogie Brill or Peckham maximum trucks are to be provided for,' and so on throughout the whole document."

AUGUST EXPORTS to Asia and Oceania show a falling off of nearly $3,000,000, as compared with August of last year. There are two reasons for this: 1st, the war in China; 2d, the refusal of exporters on the Pacific coast to furnish statements of the value of their exports to the Hawaiian Islands, which they claim are no longer foreign territory, and that therefore the Bureau of Statistics has no authority to require a statement of the quantity and value of merchandise passing between those islands and the United States. The reduction in exports to China is from $1,392,205 in August, 1899, to $216,390 in August, 1900, due, of course, to the existence of hostilities in that country. The apparent reduction in exports to Hawaii is from $1,087,421 in August, 1899, to nothing in 1900, though it is probable that if the facts were known the exports to the Hawaiian Islands in August, 1900, would show a much larger sum than in August, 1899. Notwithstanding these adverse conditions, one of which is real and the other one apparent, our exports to Asia and Oceania will show during the eight months ending with August an increase of more than 20 per cent over those of the corresponding months of last year, as against an increase of 9 per cent in our exports to the South American countries and 14 per cent in our exports to Europe. In no other part of the world do American exports show as rapid an increase as in Asia and Oceania. To Japan, our exports during the eight months ending with August amount to more than $21,000,000, as against $12,000,000 in the corresponding months of last year; to China, our exports in the seven months ending with July, up to which time the disturbances had not seriously affected the exports, showed an increase over the corresponding months of 1899 and 1898; to Hongkong, our exports for the eight months amount to nearly $6,000,000 as against a trifle more than $5,000,000 in the corresponding months of last year, and to the Philippines, our total exports for the eight months amount to $1,826,000, against $391,856 in the corresponding months of last year.

THE VILTER MANUFACTURING COMPANY, builders of refrigerating and ice making machinery, Corliss engines, etc., of Milwaukee, Wis., has recently closed contracts as follows: Richter Brewing Company, Escanaba, Mich., one 20-ton refrigerating plant and 50-barrel brewery outfit; Dostal Bros., brewers, Iowa City, Iowa, one 15-ton refrigerating plant; Glacieres de Normandie, S. A., Rouen, France, one 20-ton ice plant; Cerveceria de Sonora, Hermosillo, Mexico, one 25-ton refrigerating plant and 50-barrel brewery outfit; Theo. Hamm Brewing Company, St. Paul, Minn., direct expansion cellar piping; Cerveceria Moctezuma, Orizaba, Mexico, direct expansion cellar piping and structural iron work; Cerveceria del Pacifico, Mazatlan, Mexico, direct expansion cellar piping and 50-barrel brewhouse outfit; Mrs. J. H. Stahl, brewery, Walla Walla, Wash., one 15-ton refrigerating machine; Grand Rapids Brewing Company, Grand Rapids, Mich., direct expansion cellar piping; Jos. Schlitz Brewing Company, Milwaukee, Wis., direct expansion cellar piping; Oscar Thilmany, paper mill, Kaukauna, Wis., one 24 x 42 Corliss engine; Evergreen Manufacturing Company, Evergreen Ala., one 12 x 30 Corliss engine; C. G. Gates, Port Arthur, Texas, one 16 x 36 Corliss engine; Baltimore & Ohio Railroad elevator, South Chicago, Ill., one 24 x 48 x 48 cross-compound Corliss engine; F. Mayer Boot & Shoe Company, Milwaukee, Wis., one 16 x 36 Corliss engine; Manitowoc Aluminum Novelty Company, Manitowoc, Wis., one 15 x 36 Corliss engine; Emilson & Nelson, flour mill, Viroqua, Wis., one 10 x 30 Corliss engine; W. S. Grower, Chicago, Ill., one 18 x 42 Corliss engine; Capital Brewing Company, Olympia, Wash., one 16 x 36 Corliss engine; Rockland Cement Company, Jones Point, N. Y., one 18 x 42 Corliss engine; Newbury, Peper & Beck, machine shop, Madison, Wis., one 10 x 30 Corliss engine; Utica Cement Company, Utica, Ill., one 20 x 42 tandem compound Corliss engine.

EXPORTS OF ELECTRICAL MATERIAL.—The following were the exports of electrical material from the port of New York for the week ended Sept. 26: Antwerp—14 cases electric material, $2,016. British Australia—47 packages electric material, $4,517; 5 cases electric machinery, $1,328. Bristol—5 cases electric material, $459; 67 cases electric machinery, $4,550. Brazil—18 packages electric material, $2,234; electric railway supplies, 539 packages, $80,772; 43 cases electric machinery, $5,557. Berlin—3 cases motors, $540. British West Indies—5 packages electric material, $230. Bremen—16 cases electric material, $2,043; 13 cases motors, $2,360. British Possessions in Africa—156 packages electric material, $11,001. Bolton—2 cases motor parts, $290. Central America—1 case electric material, $27. Chili—13 cases electric material, $348; 6 packages electric machinery, $200. Cuba—14 cases electric material, $181. Ecuador—2 cases electric machinery, $120. Glasgow—10 cases electric machinery, $972; 17 cases electric material, $3,689; 1 motor, $145. Hamburg—48 cases electric machinery, $11,503; 81 cases electric material, $2,131. Havre—55 cases electric material, $4,063. Liverpool—64 packages electric machinery, $2,750; 71 packages electric material, $9,944. London—71 packages electric machinery, $2,958; 65 cases electric material, $2,390. Lisbon—69 cases electric material, $2,422. Mexico—1 case motor parts, $64; 547 packages electric material, $12,026. Manchester—5 cases electric material, $406. Newcastle—4 cases electric material, $2,960. New Foundland—4 packages electric material, $85. Nova Scotia—8 cases electric material, $41. Oporto—7 cases electric material, $368. Peru—22 cases electric material, $1,193. Southampton—3 cases electric machinery, $830; 45 cases electric material, $4,819. St. Petersburg—11 cases electric machinery, $390. 4 cases electric material, $451. Trieste—21 cases electric machinery, $847. Venezuela—241 packages electric material, $1,545.

EUROPEAN INDUSTRIAL PROSPERITY.—According to a communication to the State Department from Vice-Consul-General Hanauer at Frankfort, Germany, an industrial crisis in Europe is impending. He says: "The wave of industrial prosperity in Europe, which has steadily risen since 1895, has taken a turn and begun to recede. All signs point toward a crisis in industrial and financial lines, which may occur before two years have passed. Any political disturbance of note may bring on the crisis suddenly and without warning. * * * There are doubts if the immensely capitalized electrical works of Germany and other countries can keep fully employed after present contracts are filled. This line of industry, which in Germany alone represents an investment of nearly $300,000,000. has been largely instrumental in creating the present boom. Failures have already begun in the building trade, which in the large cities has been of a speculative nature and rested mainly on borrowed capital. The German papers speak in alarming tones of the sad position of the textile industry, where stoppages of factories are the order of the day. Late statistics of the German districts show 6022 looms idle, out of a total of 11,829. The weavers still employed there earn but 8 to 10 marks ($1.90 to $2.38) per week. The stock market is the delicate seismometer which denotes the coming upheaval. Shares of industrial companies have already commenced to decline, though the reports of their operations promise for this year large dividends. The high rates of interest which have ruled for money this year and the high taxes which capitalists and business interests must pay in Germany have also tended to affect the boom." The London *Statist* does does not take this gloomy view, by any means.

THE SIEMENS & HALSKE ELECTRIC COMPANY OF AMERICA, with factory at Chicago, has at last shut down its works—probably not to open again. This factory has had a checkered

career, never having been very successful. The company first started a well-equipped factory in the lumber yard district, Chicago, in 1892. The concern was considerably hampered by numerous German designs taken from the parent company and not suited to American competition, though excellent work was turned out. The plant was destroyed by fire in 1895, and arrangements to occupy the factory of the defunct Grant Locomotive Works were made soon after. Then also came a reorganization, in which the company changed hands and fell into the control of capitalists interested in the Yerkes street railways in Chicago, the idea being to supply the roads with apparatus. This was done to a limited extent and the general manufacturing business maintained at the same time. However, the business did not prove remarkably successful, and in 1899 another change was recorded, when the syndicate controlling the Electric Vehicle Company and allied companies bought control with the idea of turning out electric vehicle equipments along with other work. The results did not seem to be satisfactory, however, for after frequent changes in the officers of the concern the past year the General Electric Company secured control, Mr. Sam. Hamill having the matter in hand for that concern. The plant has been closed down, and as the business was a large and expensive one to maintain, it will probably not be started again unless under new conditions.

PORTO RICAN TRADE.—Four months' operations of the Porto Rican tariff law show an increase of more than 100 per cent in our exports to that island, as compared with the corresponding months of 1899, and more than 300 per cent as compared with the corresponding months of 1897 or 1896. The act went into effect May 1, 1900, so that the figures for August, which have just been completed by the Treasury Bureau of Statistics, complete the record of the fourth month of commerce between the island and the United States under the new law, and render practicable a comparison of the four months' term with corresponding periods in preceding years. The corresponding four months in 1899 cover a period in which the island was under the American flag, but subject to the customs laws of the United States which relate to foreign countries. This year the figures are: Imports from Porto Rico, $3,244,050, as compared with $1,984,572 last year, while the exports to Porto Rico from the United States this year are $2,525,845, as compared with $1,132,132 last year. The electrical part of these latter figures is likely to be much larger, if not interfered with by episodes such as we have recently recorded.

ELECTRIC LIGHT IN MONTREAL.—At the recent annual meeting of the Standard Light & Power Company, of Montreal, Que., the annual report showed the company to be in a very prosperous condition, having declared for the year an 8 per cent dividend. During the year a new station has been erected; two General Electric rotary converters have been installed which are converting alternating three-phase current from the Lachine Rapids Hydraulic & Land Company to direct current for use in the city. A steam plant of boilers, manufactured in Glasgow, has been installed, capable of developing over 2000 horse-power, and two of the latest type Westinghouse compound engines erected. The statement was made that the Standard Company is the only company in the city of Montreal to-day which has an absolutely fireproof station, operated by current produced by water power, and having a steam reserve at its command. The following officers were elected: W. McLea Walbank, president and managing director; J. H. Burland, vice-president; E. Craig, secretary.

ELECTRICAL GOODS IN TURKEY.—The U. S. chargé at Constantinople, Mr. Griscom, writes under date of Sept. 1, 1900, that about two months ago a United States firm made a shipment of electrical appliances to Constantinople. Upon arrival, the merchandise was seized in the custom house and refused admittance to the empire, the introduction of electrical appliances of any description being prohibited. Mr. Griscom caused some samples of the goods—small reading lamps, toys with storage batteries attached, etc.—to be taken to the palace and brought to the attention of the Sultan. The latter was much attracted by the novelty of the articles and bought the whole consignment for his personal use. He also issued an irade authorizing the introduction of similar articles into the country. It is to be hoped, adds Mr. Griscom, that a permanent trade may be established in this class of goods, though it should be understood that the irade does not refer to electrical appliances of all kinds. The general interdiction against dynamos, electrical plants, telephones, etc., still exists.

CIRCUIT BREAKERS FOR ROCK ISLAND ARSENAL.—The W. R. Garton Company, of Chicago, has recently taken the contract for 183 circuit breakers to be used in the electric power equipment of the Rock Island United States Arsenal. As the application of these circuit breakers is a novel one in electric shop transmission, the contract is of special interest. The power transmission to be used in the arsenal is three-phase 550-volt without the use of transformers, and the circuit breakers with be used in each leg of the three-phase circuit. Each circuit will be controlled by a set of three circuit breakers mounted on a white marble or slate slab, so that there will be 61 sets or panels, each panel having three circuit breakers. The circuit breakers will each be single-pole double-break, operated by solenoids specially designed for alternating current. The breakers will be made by the General Equipment Company, of Camden, N. J., of which the W. R. Garton Company is Western agent, and the contract calls for breakers of capacities ranging from 6 to 60 amperes.

INDUSTRIAL ACTIVITY IN CANADA.—Circulars have been issued to the shareholders of the Canadian General Electric Company, of Toroto, Ont., calling a meeting for the purpose of considering the proposal of the directors to acquire the plant of the Canada Foundry Company of that city. Up to the present time, the Canadian General Electric Company has been purchasing its castings from foundries in different parts of the country, and owing to the industrial activity of the past year or two, considerable difficulty has been experienced in securing deliveries of goods. This difficulty the directors intend to overcome by the purchase of the stock of the Canada Foundry Company, and enlarging the foundry plant.

PAN-AMERICAN BOILERS.—The Clonbrock Steam Boiler Company has secured the contract for supplying the entire power at the Pan-American Exposition, Buffalo. The plant will be 2000 horse-power, in four "Climax" units of 500 horse-power each. It is stated that these boilers were accepted for the entire power at the Pan-American Exposition after the excellent showing made in Paris during the tests. The Climax boilers have now supplied the entire power at the Trans-Mississippi Exposition, the Tennessee Centennial Exposition, the Greater America Exposition, the American exhibit at the Paris Exposition, and the larger portion of the Chicago Fair in 1893.

THE AMERICAN DISTRICT STEAM COMPANY, of Lockport, N. Y., reports an unusually busy season. The company is completing a large exhaust heating plant for the Atlanta Railway & Power Company, Atlanta, Ga., having just completed another extensive system at Seattle, Wash. Besides these, it is now engaged on exhaust steam heating plants at Champaign, Ill.; Youngstown, Ohio; Johnstown and Washington, Pa., and Cumberland, Md.; also an extension of about 9000 ft. of underground mains at Wilkinsburg, Pa., to the plant constructed by the company last year.

FOR A HAVANA BREWERY.—The H. W. Johns Manufacturing Company, of New York, has secured a contract for supplying and applying its asbestos fire felt covering for the steam pipes, boilers and brine pipes at the Havana Brewery, Havana, Cuba. The company is sending skilled labor from New York to carry out its contract. There are a number of new power plants being constructed in Havana, and the H. W. Johns Manufacturing Company believes in being on the field with its skilled labor and materials to insure its getting all the work in sight.

H. W. JOHNS MANUFACTURING COMPANY, 100 William Street, New York City, was recently awarded a contract from the Pittsburg Plate Glass Company, Ford City, Pa., for furnishing and applying its asbestos fire felt covering for factory No. 3, in which plant is now being installed twelve new boilers and the necessary steam pipes.

AMERICAN FACTORY TIMEKEEPERS WANTED IN GERMANY.—Consul Worman, of Munich, under date of Aug. 1, 1900, says that most factories in Germany have nothing like our electric timekeepers, and an effort to introduce them into Germany, especially into South Germany, where new enterprises are constantly being launched, ought to be successful.

THE R. LESTER THAYER COMPANY, of Peoria, Ill., has secured the contract for the electrical equipment of the Acme Harvester Company works at Peoria, Ill. Five hundred horse-power in generators and motors will be installed. Northern motors and generators are to be used. Mr. Thayer visited Chicago recently on business connected with the contract.

THE ELECTRIC CONTROLLER & SUPPLY COMPANY, Cleveland, Ohio, has entered the field as consulting engineers, and desires to receive catalogues, price lists, discount sheets and full particulars of wire and wire supplies, switches, rheostats, motors and storage batteries.

SOUTH AFRICA.—Now that peace is fairly well restored to a much-vexed territory, Durban, Natal, is taking up the question of an electric tramway and long-distance transmission; while famous Ladysmith is discussing the installation of a lighting plant.

TO MAKE CAR TRUCKS IN ENGLAND.—It is reported that the McGuire Manufacturing Company, Chicago, will erect a plant in England for the manufacture of electric car trucks. American machinery will be purchased for the new works.

THE NILES-BEMENT-POND COMPANY, New York, is making considerable addition to its crane plant in Philadelphia, one being an extension 40 ft x 60 ft., and the other a new building 200 ft. x 100 ft., both of which structures will be fireproof.

NEW EQUIPMENT FOR THE BOSTON "L."—The directors of the Boston Elevated Railway Company have voted to purchase a 4500-hp engine and a 2700-kw generator, to cost about $150,000.

THE OTIS ELEVATOR COMPANY has placed an order for a 300 and 150-hp engine with Messrs. A. L. Ide & Sons, Springfield, Ill.

Special Correspondence.

ENGLISH NOTES.

London Office, Electrical World and Engineer,
Sept. 22, 1900.

MR. JAMES F. CUMMINGS, well known to all in the electrical trade in the United States, has recently become a partner with Maguire & Bancus, of 5 Warwick Court, High Holborn, London. This enterprising firm has now gone strongly into the business of standard electric railway supplies and has recently acquired all the rights in England of the McGuire electric trucks, so favorably known in the States and elsewhere. It also handles the "protected" rail bond of the horseshoe type, "Phono-electric" wire particularly adapted for trolley wire purposes, and American vitrified tile conduits; and it has recently secured all rights to the flexible steel "Armorite" conduit.

WIRELESS TELEGRAPHY.—One of the most interesting features of the British Association's gatherings, held recently at Bradford, was a wireless telegraphy experiment in Lister Park, Manningham, to and from a balloon. A series of friendly messages were transmitted aloft by the operators below, but a stiff southeasterly breeze carried the balloon off at so great a speed that by the end of the first five minutes it was miles away—a tiny speck in the sky—and out of range. At such a distance the Hertzian waves failed to roll to earth the message from the car, and herein lay the failure of the experiment. The balloon landed near Sheffield, and it would appear that although the operators in Lister Park failed to get the answers, their messages duly reached the occupants of the car. The wireless telegraphy was declared to be "a perfect success up to 20 miles."

THE GENERAL POST OFFICE is working hard at their underground conduit system, and the streets of London are suffering much in consequence. No matter where one goes at present he is bound to pass through a street which is torn up for the purpose of laying down cables for the new government telephone service. Before long London, and indeed all England, will be in a sore telephonic muddle. It is the biggest scheme of its kind on record, and more than 1000 men are at work on it. It is intended, sooner or later, to embrace the whole of the country, and £2,000,000 has been appropriated for the work. The Post Office claim to be creating as little inconvenience as possible to the traffic, but it would seem, in view of the multitude of conduits of various kinds in the streets, which run at all kinds of angles, that a more careful survey of the streets would be advisable, and that some form of universal underground passage for electric wires of all kinds should be provided.

BRADFORD TRAMWAYS.—A new electric tramway route at Bradford has been opened for traffic. The length of the route is 2837 yards, consisting of 2007 yards of double line and 830 yards of single line. As in the other Bradford tramways, the narrow gauge—a width of 4 ft.—has unfortunately been adopted, with an interspace between the double lines of 4 ft. 3 ins. The average gradient is 1 in 37, and the steepest parts have a gradient of 1 in 17.46 for a distance of 75 yards, and 1 in 18.48 for a distance of 175 yards. The tramway is paved with granite setts, 6 ins. x 3 ins., on a concrete foundation 6 ins. thick, composed of one part of cement and eight parts of broken stone and clinker. The setts are grouted in pitch. The line is worked by electric motors, supplied by Witting Bros., Limited, of London, and the car bodies by the Brush Electric Company, of Loughborough. The steel rails are ot the trough type, 5 ins. deep, and they weigh 70½ lbs. to the yard. They are packed with concrete, consisting of one part of cement to four parts of granite shingle, and have been supplied by Demerbe & Company, of Belgium, who are also the contractors for the points and crossings. The total length of the tramway now laid in Bradford is 40 miles 694 yards, when reduced to single line. The whole of the overhead work is being done by Messrs. Macartney & McElroy, of London.

THE WORTHINGTON PUMPING ENGINE COMPANY, London, has just issued an interesting pamphlet in French and English descriptive of its magnificent exhibit at the Paris Exposition. The first page gives a plan of the Exposition, showing where each Worthington pump is installed, a large number of them being used for the Château d'Eau at one end of the Champ de Mars, where the crowds are never tired of looking at the beautiful cascade and fountains. The whole comprises the largest exhibit of pumping machinery ever exhibited. The exterior and the interior of the Pavilion Worthington are also illustrated. In the interior are situated four Worthington triple-expansion, high-duty, pumping engines, having a capacity of 40,000,000 imperial gallons per day. The equipment of the Eiffel Tower is also described, and the various exhibits in Machinery Hall.

THE THAMES EMBANKMENT.—The scheme of electrically lighting the Victoria Embankment will be commenced probably about the beginning of November. Tenders have already been accepted for laying the mains, and the whole of the lamp standards have been purchased. The scheme is expected to be completed by early summer next year. The total number of lamps will be 144, and they will be divided into nine electrical circuits. The lamp standards will be 24 ft. in height, and the lamps will be suspended over the roadway from an extending arm. The generating station, which adjoins the District Railway station at Charing Cross, has been erected, and the plant, including dynamos, of which there are four, and the engines are to be installed immediately. The whole of the material has been made in England. The scheme was devised by Sir A. Binnie, chief engineer to the Council, who will also supervise its execution.

General News.

THE TELEPHONE.

WEST POINT, VA.—The Southern Bell Telephone Company will put in an exchange at West Point.

HARRISBURG, PA.—The Delmar & Hoytville Telephone Company has been in.orporated. Capital, $2,000.

SOUTH WHITNEY, IND.—The South Whitney Telephone Company has been organized. Capital stock, $30,000.

PASSAIC, N. J.—The New York & New Jersey Telephone Company has just completed a handsome exchange here.

SALEM, OHIO.—The Central District Printing & Telegraph Company is rebuilding its exchange here with modern apparatus.

COLLINWOOD, OHIO.—The Village Council has granted the application of tne Cleveland Telephone Company to extend its system into the town.

SUSQUEHANNA, PA.—The Susquehanna Telephone & Telegraph Company, of Susquehanna Depot, Pa., has been incorporated. Capital, $5,000.

HOUSTON, TEX.—The Southwestern Telegraph & Telephone Company has completed a temporary telegraph line between Houston and Virginia Point.

PITTSBURG, PA.—The Carnot Telephone Company has applied for a charter. The incorporators are Francis P. Averill, George O. Somerville and Charles Dally.

INDEPENDENCE, KAN.—The Missouri & Kansas Telephone Company has commenced an extension of its line from Oswego to this city and west to Winfield.

HAMILTON, OHIO.—The West Butler County Telephone Company has asked for a franchise to place a limited number of telephones and toll stations in certain portions of Hamilton.

FARMLAND, IND.—The Farmland Telephone Company has been incorporated. Capital, $10,000. Incorporators: T. W. Botkin, W. C. West, H. D. Good, J. T. Wright, J. Nixon, all of Farmland.

INDIANAPOLIS, IND.—The Noble County Telephone Company has filed articles of association with the Secretary of State. Capital stock, $15,000. The company will construct a line in Noble County.

TOLEDO, OHIO.—The Ottawa County Telephone Company, Oak Harbor, has been incorporated. Capital, $30,000. Incorporators: H. Metzgar, E. D. Harkness, J. G. Steinkamp, T. Fuller, F. W. Gradolph.

AKRON, OHIO.—The Akron People's Telephone Company will soon be given long distance connection with Columbus, Pittsburg, Medina and Canton over lines being built by the United States Telephone Company.

MASSILLON, OHIO.—The Massillon Telephone Company has been incorporated. Capital, $75,000. Incorporators: E. E. Fox, J. W. McClymonds, J. H. Hunt, J. C. F. Putnam, O. E. Young, H. A. Croxton, J. B. Hoge.

ALBANY, OHIO.—The Albany & Vales Mills Telephone Company has been incorporated. Capital, $10,000. Incorporators: J. Q. A. Vale, L. P. Vale, W. G. Caster, E. Caster, D. L. Webb, Elizabeth Webb, S. D. Webb, Lizzie Webb.

STEVENS POINT, WIS.—The Stevens Point Telephone Company has been partially organized for the purpose of establishing a local exchange. If a franchise is granted the new company will be incorporated with a capital of $15,000.

MINNEAPOLIS, MINN.—The Mississippi Bell Telephone Company expects to install 3000 additional telephones within the next 60 days. The company also contemplates the erection of two sub-exchange buildings by the first of next year.

RACINE, WIS.—The stockholders of the new Citizens' Telephone Company have organized, with a capital of $25,000, which will ultimately be increased to $150,000. The company is ready to commence work on the plant, which is to cost $57,000.

WABASH, IND.—Connections were made Sept. 24 that give this city telephone communication with Indianapolis by the new independent line. The rate is 40 cents for five minutes, as against 55 cents for three minutes charged by the Bell Company.

GREENSBURG, IND.—The Greensburg Telephone Company, which recently incorporated with a capital stock of $30,000, is making good use of the favorable weather to push the work of construction of its line through Decatur and adjoining counties.

KOKOMO, IND.—There is a fierce war waging in this city between the Central Union Telephone Company and the New Independent Telephone Company, which has just completed a splendid plant at an expense of $30,000 with 425 subscribers to start with.

ALLIANCE, OHIO.—Emmett R. Morgan has been appointed general manager of the new Stark County Telephone Company. The new company is allied with the Columbiana County Telephone Company, and it is preparing to build exchanges at Alliance and Canton.

NEW YORK, N. Y.—The Lambert Schmidt Telephone Manufacturing Company, principal office 93 Maple Street, Weehawken, N. J., has been incorporated. Capital, $50,000. Incorporators—Lambert Schmidt, Samuel B. Fowler, Walter W. Bostwick, Jr., and George Fritz.

INDIANAPOLIS, IND.—The telephone line extending from New Augusta to this city was completed on Sept. 22. The company's exchange at New Augusta has 27 telephones connected, and the wire to this city connects with the central station of the New Telephone Company.

NEWARK, OHIO.—Citizens of Granville have cut the wires and destroyed the poles of a long distance line built through the town by the United States Telephone Company. The company agreed to install 50-ft. poles, but instead used shorter ones, thus damaging many shade trees.

MASSILLON, OHIO.—The Massillon Telephone Company, with a capital stock of $75,000, has been organized, and the plant of the Farmers' Telephone Company of this place has been purchased by the new company. The new company is allied with the Columbiana County Telephone Company.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has begun work on its tunnel under the river at Mason Street. The tunnel will be constructed of heavy iron pipe 4 ft. in diameter. Its total length will be 255 ft., and its cost about $25,000. The tunnel will contain 8000 wires or 4000 metallic pairs.

ABERDEEN, MISS.—The Mississippi Independent Telephone Association has been organized, with Hugh Campbell, president; L. B. Camp, vice-president; A. W. Kearley, secretary and treasurer, and C. W. Bolton, assistant secretary.

The object is to consolidate all of the independent telephone companies in the State, connect all lines and exchanges and generally improve the service.

RAVENNA, OHIO.—A list of business men, including all the grocers, nearly all the butchers and grist mills and a number of other business houses have issued a notice that they will discontinue the use of the telephones of the Central Union Company on Oct. 1. The announcement was made in the interest of the Ravenna Home Telephone Company, which is owned by local people.

DUNKIRK, N. Y.—The Dunkirk Home Telephone Company, of Dunkirk, has been incorporated to operate in the city of Dunkirk and the towns and villages of Chautauqua County. Capital, $100,000. Directors: Albert R. Smith, Tonawanda; George H. Frost, Buffalo; Addison E. Lord, Samuel B. Rawson, Irving H. Griswold, James A. Drake, Frederick H. Sudro and Clayton Chapman, Elyria, Ohio.

WASHINGTON, D. C.—The signal officer has received a report from Lieut. D. G. Burnell, who is constructing the telephone line from Fort Valdez to Fort Egbert. He hopes to have the line constructed and in use this winter. Fort Valdez is on the open sea, about 100 miles north of Juneau, and near the mouth of the Copper River, while Fort Egbert is the post on the Yukon near the eastern boundary line.

MINNEAPOLIS, MINN.—The stockholders of the Minnesota Central Telephone Company, which operates 800 miles of line in Minnesota, recently held their annual meeting in this city. The directors elected were: D. N. Tallman, John Williams, Willmar; Charles Webster, A. Webster, Waucoma, Ia.; E. G. Porter, Owatonna, Minn. The officers elected are: D. N. Tallman, president and treasurer; Charles Webster, vice-president, and John Williams, secretary.

MARSHFIELD, WIS.—Work has been started on the telephone line between this city and Grand Rapids. It is expected that this long-felt want will be a realization before Dec. 1. The line will be about 35 miles long and will be built by the way of Pittsville, and branches from there to Dexterville and Babcock and possibly to Vesper and Sherry. Connection will also be made with the Seventh Day Adventists' College, 12 miles east of here. The incorporators of the new company are: John A. Gaynor, E. P. Arpin, George M. Hill and A. W. Bryant, of Grand Rapids, and Karl W. Dolge and F. A. Cady, of this city.

ELECTRIC LIGHT AND POWER.

HICKORY, N. C.—An electric light plant at this place is one of the possibilities of the near future.

WASHINGTON, N. J.—The Washington Electric Light Company has been incorporated. The capital stock is $50,000.

HARRISBURG, PA.—A charter has been issued to the Johnstown Light, Heat & Power Company, Johnstown, Pa. Capital, $35,000.

MARION, VA.—A franchise for the construction of electric light plant has been granted to Palmer & Groscup, of Washington, D. C.

ATLANTA, GA.—The Atlanta Railway & Power Company has been granted a franchise for the construction of an electric light and power plant.

LAKE PROVIDENCE, LA.—The city is now asking bids on its authorized $17,500 of bonds for the construction of a lighting plant and water works.

OTTAWA, ONT.—The Miner-Graves syndicate has under consideration a project for transmitting electric power from Grand Forks, British Columbia, to Phœnix.

KINGSTON, ONT.—The city of Kingston is making arrangements to take over the electric light and gas plants in this city now operated by a private corporation.

SARNIA, ONT.—The Street Railway Company here, at a recent meeting of the shareholders, appointed a committee to secure tenders for changing the road to an electric system.

ARCADIA, IND.—The electric light plant of this city, owned and controlled by A. E. Goodykontz, was destroyed by fire recently. The loss will reach $15,000, with $7,500 insurance.

FREDERICKSBURG, VA.—Kingsbury, Samuel & Company, of Baltimore, Md., have submitted the lowest bid ($9,999.45) for the erection of the electric light plant.

RENFREW, ONT.—The Renfrew Electric Company is making arrangements to develop additional water-power, erect an addition to its present power house and generally to increase its plant.

WOLFVILLE, N. S.—The Electric Light & Heating Company, of Wolfville, Nova Scotia, has purchased water privileges on the Gaspereau River, and will develop the same for electric purposes.

MILWAUKEE, WIS.—Messrs. Keelyn and Smith have closed contracts to furnish the Milwaukee Chair Company and the B. Uhrig Fuel Company, of this city, with complete electric light plants.

BRANTFORD, ONT.—The Brantford Electric & Operating Company is building a new power house of brick with concrete foundations; water-power will be used, the capacity being 1200 horse-power.

ALBANY, N. Y.—The Gowanda Electric Light & Power Company, of Gowanda, has been incorporated. Capital, $10,000. Directors: Charles E. Sipple, Charles P. Dean and George B. Pratt, Gowanda.

COUNCIL BLUFFS, IA.—The Bluff City Electric Light & Gas Company, Council Bluffs, has been incorporated. Capital, $50,000. Incorporators: T. Brown, J. P. Greenshilds, both of Council Bluffs.

ALBANY, N. Y.—The Lester Heights Water & Power Company, of Union, has been incorporated. Capital, $16,000. Directors: G. S. Ackley, Binghamton; E. W. Van Slyke and M. S. Squires, Lestershire.

MILWAUKEE, WIS.—George F. Rohn has closed a contract with the Seminary of St. Francis, St. Francis, Wis., for a 200 ampere-hour storage battery plant, to be used in connection with the present lighting plant.

SPRINGFIELD, ILL.—The Citizens' Electric Company, of Clinton, Ill., has been incorporated, with $15,000 capital, to operate light, heat and power plants. The incorporators are E. S. Nixon, Titus Hinchcliffe and W. W. Newman.

NEW LISBON, WIS.—The Juneau County Electric Company has finished putting in the telephone system, and about 70 telephones are now installed. Toll lines will run from New Lisbon to Necedah, Manston, Camp Douglas and Hustler.

ALBANY, N. Y.—The Broadalbin Electric Company, of Broadalbin, has been incorporated. Capital, $25,000. Directors: Henry B. Oakman, E. H. Tucker and T. Arthur Farley, Brooklyn; L. U. Shafter, Rockville Centre, L. I.; Charles F. Lehmann, Smithtown, L. I.

ALLIANCE, OHIO.—S. Joliat has been awarded a contract for the erection of the building and stack for the new municipal lighting plant. His figures were $9,897.80 for the building and $2,549.22 for the stack. Contracts for the machinery have not yet been placed.

OTTAWA, ONT.—The development of power on the Assiboine River in Winnipeg, Manitoba, is again proposed. Some years ago Messrs. N. H. Ruttan, C.E., of Winnipeg, and J. F. Fanning, of Minneapolis, Minn., made reports of this project which established its feasibility.

FLORENCE, ALA.—Edward J. O'Bierne, of Birmingham, has presented a proposition to the City Council for a franchise to put in an electric light plant for 50 years. He agrees to furnish street lights at the rate of $60 each at any time within the limit of the franchise.

IROQUOIS, ONT.—Mr. M. F. Beach, of Iroquois, has applied to the Ontario Government for a lease of water-power near this town, his intention being to develop the power for electric purposes and for the operation of an electric railway between Iroquois and the city of Ottawa.

UTICA, N. Y.—It is stated that the plant of the Dolgeville Electric Light & Power Company at High Falls will soon become the property of the Herkimer County Light & Power Company. The Dolgeville Company's plant is operated by water-power and is modern in every respect.

QUEBEC, QUE.—It is reported that the Canada Electric Light Company, of Levis, Quebec, is now making arrangements to supply electric-power to a large pulp mill which will be erected on the Chaudiere River, the stock to be offered pro rata to the shareholders in the electric company.

SAN FRANCISCO, CALIF.—The Merchants' Gas & Electric Company has been incorporated, with San Francisco as the principal place of business. Directors: V. Stow, R. J. Woods, A. A. Sanderson, E. C. Hutchinson, San Francisco, and E. B. Davis, of Oakland. Capital stock, $1,000,000.

KELSO, TENN.—A company will be organized to develop the water-power of the Elk River, near Kelso, and transmit the power electrically. It is said that the construction work will cost $35,000. R. D. Warren, C. D. Bagley and W. R. Webb, of Bellbuckle, Tenn., are reported as interested.

MANITOWOC, WIS.—Municipal ownership of the electric light plant has again been taken up. A committee has been appointed to consult with the company as to the best possible terms upon which the plant can be obtained. A majority of citizens are in favor of the city owning the plant.

HOOSICK FALLS, N. Y.—The Hoosick Falls Electric Company, Hoosick Falls, has been incorporated. Capital, $85,000. Incorporators: W. E. Heaton, E. Tiffany, both of Hoosick Falls; G. W. Davenport, of Winchester, Mass.; O. D. Young, of Cambridge, Mass.; C. N. Grey, of Boston, Mass.

CHICAGO, ILL.—The village of Harlem has voted to advertise for bids for the construction of an addition to its lighting plant, with a capacity of 2500 incandescent lights. The present plant, which is operated by the village, supplies the street lighting, and it is thought that some revenue can be derived by engaging in private lighting.

WINDSOR LOCKS, CONN.—The Windsor Locks Electric Lighting Company has taken down its smokestack and is preparing to put in a boiler of 250 horse-power. The company will make other improvements toward increasing the power of its plant. It probably will soon be able to furnish power for light manufacturing purposes.

SAN FRANCISCO, CALIF.—A large amount of electric wiring of mining works on the Comstock Lode in Virginia City, Nev., has been completed. The Sierra Nevada and the Union were recently finished under the supervision of Mr. C. E. Dutcher. The companies are now ready to receive power from the Truckee General Electric Company's lines.

OTTAWA, ONT.—The Rimouski Electric Company (La Compagnie Electrique de Rimouski) has been formed, with a capital of $100,000, at St. Germain de Rimouski, Quebec, to furnish electric-power to operate factories, etc. Thomas Lebel, of Fraserville; Joseph Norbert, of St. Germain; D. Caron and A. C. Landry, of St. Octave de Metis, are the promoters.

BENICIA, CALIF.—The Solano Electric Light & Gas Company proposes to shut down its steam plant and buy power from the Bay County Power Company, whose plant is operated by water-power. The Solano Company needs new transformers and material, and supplies for wiring buildings, besides general supplies. Mr. Peter Anderson is the company's electrician.

FERGUS FALLS, MINN.—The water-power supply for the electric light station has been shut off in order to make some necessary repairs at the dam, and the city will be in darkness for some weeks to come. Excavations were being made for a new steel penstock at the dam when soft earth was discovered, causing a leakage and threatening a cave-in. It was to avoid this possible damage that the water was shut off until the new work is completed.

MONTANA.—Considerable interest is being taken locally in the work being done by the electric power company at the Madison canyon, six or eight miles from Norris. This company has about 60 men at work on the flume, which is to be 10 ft. high, 14 ft. wide and 2500 ft. long. It is expected 1600 electric horse-power will be furnished to the mines of Red Bluff, Norris and mines of the surrounding country. Besides the men working on the flume, a large force is engaged in getting out poles for the transmission line.

APPLETON, WIS.—At a meeting of the Appleton Electric Light & Power Company a change in management, contemplated for a year past, was made. A. L. Smith, L. E. Barnes and J. M. Baer, of Appleton, and Arthur D. Wheeler, of Chicago, resigned from the directory, and a new board was elected, consisting of John I. Beggs, H. D. Smith, J. S. Van Nostwick, Henry C. Payne and Charles F. Pfister. Mr. Beggs was elected president, and H. D. Smith, secretary and treasurer. The executive committee consists of J. I. Beggs, H. D. Smith and J. S. Van Nostwick. A. L. Smith was relieved from the management of the company at his own request.

BURBON, IND.—The City Council, on Sept. 19, passed a resolution placing the Burbon Electric Light Company in a somewhat embarrassing position. A $30,000-plant was erected here, and it is alleged that the construction company deviated from the plans and specifications. An injunction was had restraining the city from accepting it. No move has been made to remedy the defects. The resolution calls on the company to complete the plant according to the original design within 90 days, or else remove it. The company says it is impossible to do the work in that time.

PITTSBURG, PA.—Mr. John K. Ewing, Jr., of Uniontown, Pa., has succeeded in interesting a number of New York capitalists in a project of utilizing the power of the Ohiopyle falls and constructing a power house to generate electricity, which is to be supplied to the manufacturing towns along the Youghiogheny River and the Monongahela, as far as Pittsburg. Surveys have been made by engineers and hydraulic experts, and from their examination it has been learned that a fall of 110 ft. in a distance of 2000 ft. is possible, and that 20,000 horse-power can be obtained at the lowest stage of the river.

THE ELECTRIC RAILWAY.

HIRAM, OHIO.—A lighting plant is to be installed in Hiram College, and a 100-hp Fisher engine.

SHERMAN, TEX.—J. P. Harrison and others are considering the formation of a company to build an electric line in the city.

BRISTOL, VA.—The Bristol Belt Line Railway Company has obtained a franchise to use a number of streets for its electric system.

TOLEDO, OHIO.—The Maumee Valley Electric Railway Company is making preparations for an immediate extension of its line to Waterville.

CANTON, OHIO.—J. M. Ferguson, of Steubenville, is promoting a project to build an electric line from Canton to Steubenville via Carrollton.

COLUMBUS, OHIO.—The Columbus Railway Company is making plans to build an electric line on a newly-completed county road to Arlington.

TWO RIVERS, WIS.—The Council has granted a 35-year franchise to Thomas Higgins, of Neenah, to build an interurban electric line to Manitowoc.

HAMILTON, OHIO.—The Hamilton & Lindenwald Electric Transit Company has been granted a 25-year franchise for an additional track on Second Avenue.

CLEVELAND, OHIO.—F. D. Carpenter, L. M. Coe and Jacob Mayer, of this city, have secured a franchise in Wapakoneta for a new line to extend from Lima to Sidney.

NEW YORK, N. Y.—A resolution to compel the Brooklyn Rapid Transit Company to put its trolley wires underground has been introduced in the Municipal Council.

ALLIANCE, OHIO.—Simon Harrold has closed a contract for the construction work of the Alliance, Sebring & Salem Electric Railway. The work is to be started at once.

ELKHART, IND.—There is a warm agitation here over the advisability of taking steps toward municipal ownership and control of the street railway and other public utilities.

FOSTORIA, OHIO.—The Toledo, Fremont & Norwalk Electric Railway Company is securing right of way for a branch line from Findlay to Fremont, passing through this place.

NEWARK, OHIO.—The motormen and conductors employed by the Newark Street Railway Company went on a strike recently because several of their number were discharged.

CLEVELAND, OHIO.—Charles Dunbar and Daniel Gindlesperger of Brecksville are securing right of way for an electric line from Cleveland to Medina passing through Brecksville.

BOSTON, MASS.—The Brockton & Plymouth Street Railway Company, W. C. Forbes, president; E. J. B. Huntoon, treasurer, has filed a certificate that its entire capital, $150,000, is paid in.

GREENWICH, CONN.—Despite the protests of wealthy New Yorkers having their summer homes here, the work of building the trolley in Greenwich will probably begin in two or three weeks.

CHICAGO, ILL.—The Union Traction Company reports gross earnings for the month of August of $682,816, an increase of $10,767. July showed a loss of $22,919 as compared with July, 1899.

LEXINGTON, MICH.—The Township Board has granted a franchise to the Detroit, Lexington & Lake Huron Electric Railway through the township, the road to be completed by Dec. 31, 1901.

SALEM, OHIO.—W. H. Klein, of Pittsburg, promoter of the Alliance, Sebring & Salem Electric Railway, has secured an option on the road and power house of the Salem Electric Railway Company.

COLUMBUS, OHIO.—The Urbana, Mechanicsburg & Columbus Electric Railway Company has secured all franchises from Urbana to Columbus, and that portion of the road will be pushed to completion.

HAMILTON, OHIO.—The Southern Ohio Traction Company denies the report that it is preparing to haul freight into the city. The business will be confined to express and light packages, as in the past.

HAMILTON, ONT.—The Cataract Power Company has made application to the Township Councils of Barton, Saltfleet and Grimsby for right of way for an electric railway from Hamilton to Grimsby, Ont.

TOLEDO, OHIO.—The Toledo, Fostoria & Findlay Electric Railway Company has given a contract to the Dover Construction Company of Canal Dover for the building and equipment of its road between Fostoria and Findlay.

TOLEDO, OHIO.—The Toledo & Monroe Electric Railway Company has completed its road as far as the State line, and cars will be placed in operation by Dec. 15. The company will run its cars over the Toledo Traction Company's line.

CLEVELAND, OHIO.—The Northern Ohio Traction Company has made application to the Cuyahoga County Commissioners for a franchise permitting it to double-track its road within the county limits. The entire road is to be double-tracked.

COLUMBUS, OHIO.—Col. George D. Fredd, who is promoting a new electric railway line from Chillicothe to Columbus is stated to have been successful in financing the project and a construction company is to be formed at once to build the road.

FRANKFORD, DEL.—The citizens of Frankford have offered to contribute $5,000 toward the construction of the proposed trolley road from this place to Ocean View, and the people living along the line are also willing to help further the movement.

TOLEDO, OHIO.—The Maumee Valley Electric Railway Company has decided to double-track its entire road. Among other improvements a long trestle near this city will be replaced by a steel bridge, reducing the grade at that point fully one-third.

JACKSON, MICH.—The Jackson Street Railway Company was purchased from the receiver by a New York broker for $155,000. It is expected that it will be consolidated with the Kalamazoo, Battle Creek & Jackson Electric Street Railway system.

SMETHPORT, PA.—The Smethport Electric Street Railway Company has been incorporated. Capital, $12,000. Incorporators: J. G. Todd, F. D. Gallup, J. W. Bonton, J. F. Davis, all of Smethport; C. D. Comes, J. E. Rooney, both of East Smethport.

COLUMBUS, OHIO.—If the City Council grants the franchise application now pending, the Urbana, Mechanicsburg & Columbus Electric Railway Company has made plans to place all contracts for material and to start the work of construction at once.

TOLEDO, OHIO.—Local and Eastern capitalists have practically secured the right of way for an electric road from Toledo to Bryan. The road will pass through Holland, Swanton, Wauseon, Archbald and several other towns and will parallel the Lake Shore Railway.

ALBANY, N. Y.—The Archibald Brady Company, of Syracuse, N. Y., has been incorporated, to construct street surface railroads, electric lighting plants. Capital, $50,000. Directors: William K. Archibald, New York City; Paul T. Brady and Robert E. Drake, Syracuse.

CONCORD, N. H.—The Boston & Maine Railroad has filed a petition with the State Supreme Court asking for authority to build an electric railroad from Concord to Nashua. The building of this road would complete electric railroad connection between this city and Boston.

ST. LOUIS, MO.—The St. Louis & St. Charles Electric Railway wants to build a bridge across the Missouri River at St. Charles and run into that city. A franchise is wanted by that company which will give the city a complete street railway system. A bill is now before the Council.

MANSFIELD, OHIO.—Negotiations are under way for the sale of the franchise secured by T. Y. McCray for an electric road between Mansfield, Savannah and Wellington to Mr. Elkins, of Philadelphia. Report has it that the terms will be $50,000 in cash and a block of stock in the road.

BOSTON, MASS.—The Waltham Street Railway Company has been chartered, with a capital of $60,000. The directors are: Henry S. Milton, B. S. Tolman and R. B. Baker, of Waltham; Fred C. Hinds, G. T. Avery and E. D. Van Tassel, of Newton, and G. H. Wilson, of Brookline.

LIMA, OHIO.—The employees of the Lima Street Railway Company went on a strike recently. Their chief grievance was the fact that the company had posted notices in cars requesting passengers to report failure to register all fares and any unbecoming conduct on the part of employees.

BOSTON, MASS.—The Lawrence & Methuen electric road has been chartered. Capital, $70,000. This road will run in conjunction with the new Haverhill & Methuen line, capital $60,000, both connecting with the Hudson, Pelham & Salem road in New Hampshire.

TORONTO, ONT.—Alderman Lamb is having prepared an act for incorporation of the Toronto & Central Ontario Electric Radial Railways Company, with a capital of $5,000,000, to construct and operate the system in conjunction with the different municipalities through which these railways will run.

TRENTON, N. J.—The New Jersey & Philadelphia Street Railway Company has increased its capital to $750,000. When completed it will be 16 miles in length, using 70-lb. T-rails. The equipment will be of the General Electric Company make. A brick power house will be built. Mr. James F. Shaw is treasurer.

COLUMBUS, OHIO.—The Ripley Northern Railway Company, of Ripley, was incorporated, with $10,000 capital, by Ernest Bambach, E. E. Galbreath, John W. Adkins, G. R. Young, Albert White, J. C. Newcomb, P. D. Newcomb, J. S. Atwood and J. E. Kirkpatrick. They will build an electric railway from Ripley to Hillsboro.

COLUMBUS, OHIO.—The Columbus, Buckeye Lake & Newark Traction Company has filed a mortgage for $1,000,000 to the Knickerbocker Trust Company, of New York. A. J. Warner, of the company, is at present in New York placing contracts for material and equipment. A large park is to be established at Buckeye Lake.

COLUMBUS, OHIO.—The Columbus, London & Springfield Electric Railway Company is making arrangements for the lease of a building to be used as a

temporary power house. A permanent building will be erected at London. The three-phase system will be used and current for the entire road will be furnished by one power house.

WORCESTER, MASS.—The directors of the Consolidated Street Railway Company have voted to permit all Worcester school children to ride for half-fare to and from school and set apart the hours 7:30 to 5 or 5:30 o'clock as the hours in which the half-fare checks may be used by school children. The tickets will be sold 10 for 25 cents, or 40 for $1.

GALVESTON, TEX.—Maj. R. B. Baer, receiver of the Galveston Street Railway Company, thinks the company's losses by the recent hurricane will be at least $200,000. It will be necessary for Major Baer to have an order from court and also from the proprietors before he can purchase new machinery, and he has not heard from either of these yet in regard to it.

SAN FRANCISCO, CALIF.—Plans looking toward the abolishing of cable and substituting the trolley on all the lines of the Market Street Cable Railway Company, in Western and Richmond districts, have been presented to the directors by Superintendent of Construction Henry J. Lynch, and will doubtless be accepted. The remodeling involves the expenditure of $500,000.

DAYTON, OHIO.—The promoters of the Dayton, Lebanon & Cincinnati Electric Railway, known as the Wolfe-Sunderland combination, have secured franchises through Montgomery County and in Centerville, Dayton and Lebanon. Another company, headed by J. B. Swing and F. C. Black, has made an application for a franchise for a similar road to the commissioners of Warren County.

HAMILTON, OHIO.—The Southern Ohio Express Company, with a capital stock of $2,500, has been incorporated by W. C. Shepard, O. V. Parrish, Warren Bicknell, F. J. J. Sloat and J. K. Randall. The company will conduct an express and freight business over the lines of the Southern Ohio Traction Company. Direct connection will be made with Cincinnati over the College Hill city line.

ALBANY, N. Y.—The Rockland County Traction Company has been incorporated, with a capital of $300,000. The road is to be 30 miles in length, and is to be constructed entirely in Rockland County. Charles W. Reed, of Brooklyn; Franklin H. Reeve, George F. Carpenter, George M. Carpenter, S. A. Osborne, of Brooklyn, and Paul M. Goodrich, of Brooklyn, are the shareholders.

COLUMBUS, OHIO.—John T. Adams, acting in behalf of the whole city, has brought suit to test the franchises claimed to be owned by the Columbus Railway Company. The suit attacks the Main Street line franchise and upon the decision of the court will depend the franchises held by the company on West Broad Street, Oak Street and East Long Street. The case will be given an early hearing.

COLUMBUS, OHIO.—The Columbus Railway Company has presented to the City Council a draft for concessions desired by the company. The company wants franchises for new lines to connect those of the Columbus City Company with those of the Columbus Central Company, both of which are now parts of the Columbus Railway Company; also a blanket franchise to include all of the city lines.

TORONTO, ONT.—At intervals for several years past the directorate of the Toronto Electric Street Railway has tried to buy out the Metropolitan Electric Railway, which also operates in the city of Toronto and environs. Negotiations are now under way again, with good prospects of a successful issue. If the Metropolitan railway is acquired by the Toronto Street Railway Company, the former road will be extended at once to the shores of Lake Simcoe, Ont.

SANDUSKY, OHIO.—The Sandusky, Bellevue, Monroeville & Norwalk Electric Railway Company has given a mortgage for $600,000 on all its property to the Commonwealth Title Insurance Trust Company, of Philadelphia. The mortgage is to secure the issue of 600 $1,000 bonds which have been sold to Philadelphia capitalists. Contracts have been placed for the material for road construction, and ground has been broken for a new power house near Monroeville.

PHILADELPHIA, PA.—At the annual meeting of the Union Traction Company, held here recently, the following directors were elected: Thomas Dolan, William L. Elkins, Alexander M. Fox, John B. Parsons, William H. Shilmerdine, Alfred Smith, J. J. Sullivan, P. A. B. Widener, George D. Widener, George W. Elkins, Alexander Balfour and Charles O. Kruger. The treasurer's report showed that the net earnings for the fiscal year ending June 30 were $938,020.96.

YOUNGSTOWN, OHIO.—Penhale & Fisher, New York bankers, have succeeded in financing the new Youngstown & Sharon Railway Company, and the work of construction will start at once. Mr. Harry G. Hamilton will have charge of the building of the road. A large power house will be located here. Contracts for the material will be placed in the near future. The officers of the company are: M. H. Park, president; J. C. Whitlow, vice-president; B. F. Wort, secretary-treasurer.

COLUMBUS, OHIO.—The Columbus, Mt. Sterling & Washington C. H. Electric Railway Company has been incorporated by Cyrus P. West, William R. Smith, Frank Johnson, Hugh K. Stewart and D. I. Worthington. The temporary capital stock is $10,000. The road will extend from Columbus to Washington C. H., and the company has completed arrangements to enter this city over the Grove City line of the Columbus Railway Company. Franchises have been secured in Fayette County and Washington C. H.

CLEVELAND, OHIO.—It is said that the stockholders of the Cleveland & Eastern Electric Railway Company recently prevented the possibility of a consolidation between the Cleveland & Chagrin Falls Electric Railway and the Chagrin Falls & Eastern Electric Railway Company by purchasing 1140 shares of stock in the former company, thus precluding the possibility of a two-thirds vote necessary to effect the consolidation. Both the Cleveland & Eastern and the Chagrin Falls & Eastern companies are building lines to Middlefield, and the move was made to prevent through competition between Cleveland and that place.

SPRINGFIELD, OHIO.—Stockholders of the American Railway Company, of Philadelphia, who own the local street railway and lighting plant, met here recently and elected new officers. The new officials of the street railway company are as follows: President, Oscar T. Martin; vice-president, W. J. Crowley; secretary and treasurer, C. L. S. Tingley. Directors, W. J. Crowley, S. G. DeCoursey, W. H. Shilmerdine, Silas W. Pettit, Oscar T. Martin, Theo. Troupe, John H. Miller and C. L. S. Tingley. A number of improvements will be made to the road, and Lansdowne Park will be opened up as a summer resort next spring.

BURLINGTON, VT.—E. D. Bennett as receiver has sold at auction the power house, with its equipment, the furniture and fixings in the casino, the cars and considerable supplies belonging to the Bennington & Woodford Electric Railway. The road was built in 1895, and run up the Green Mountains to Glastenbury, a distance of nine miles. It was operated only in summer, but has done nothing since the freshet in 1898, when it was damaged beyond repair. The power station and equipment was sold to I. E. Gibson, treasurer of the Bennington & Hoosick Electric Railroad for $680. The original cost of the property sold was over $30,000.

ST. LOUIS, MO.—At a recent mass meeting the striking street car employees adopted resolutions calling off the strike and boycott against the St. Louis Transit Company, and furthermore declared that any member of the union applying for work to the transit company would not endanger his membership thereby. The strike was ordered May 8, and called off on July 2. A week later it was reordered and the boycott imposed. During the strike and the boycott 20 or 30 lives were lost and 100 or more persons wounded, while the property loss is variously estimated at from $1,000,000 to $2,000,000 direct, and five times that amount indirect, while the damage to the business interests of the city is incalculable.

NEW INDUSTRIAL COMPANIES.

THE MEAD ELECTRIC COMPANY, of Marion, Ind., has been incorporated to manufacture electrical supplies. Capital stock, $100,000.

THE ACME ELECTRICAL COMPANY, a Philadelphia concern, with a capital stock of $100,000, has been incorporated in Delaware, to manufacture electrical appliances.

THE STATION EQUIPMENT COMPANY has been formed in Chicago to manufacture electrical machinery. Capital, $25,000. Incorporators: C. S. Andrews, E. G. Fassett, G. Brockway, all of Chicago.

THE EMPIRE INSULATED WIRE COMPANY has been organized in New York City, to manufacture wire and electrical supplies. Capital, $25,000. Incorporators: J. E. Roeser, New York; S. B. Ferris, Madison, N. J., and J. B. Clark, Brooklyn, N. Y.

THE LIGHTWEIGHT BATTERY COMPANY, of Newark, N. J., has been incorporated, to deal in electrical batteries, etc. Capital, $500,000. Incorporators: A. G. Voght, F. K. Irving, P. T. Austen, H. Tuttle, L. S. Mott; H. Tuttle, attorney, Paterson.

THE SHADOWLESS ARC LIGHT COMPANY has been organized in Pittsburg, Pa., to manufacture and deal in shadowless arc lights, etc. Capital, $15,000. The incorporators are: W. G. Nixon, Pittsburg, and J. J. Houlahan, C. Tepel and C. Koenig, of Bennett, Pa.

THE HOWARD ELECTRIC COMPANY has been formed in Kansas City, Mo., with a capital stock of $20,000. The stock is held by J. H. Howard and W. T. Voight, Kansas City, Kan.; W. P. Robinson, W. L. Poffenberger and E. L. Massie, who is the attorney.

THE ROMANELLI-RAFTER ELECTRIC CHEMICAL COMPANY, of New York City, has been incorporated to manufacture electrical batteries. Capital, $500. Directors: Edward Rafter, New York City; Gennaro Romanelli and Dennis M. Shea, Madison, N. J.

THE NEELY ELECTRIC COMPANY has been organized at Washington, D. C., to manufacture and deal in electrical appliances. Capital, $50,000. The incorporators are: F. C. Behrens, L. C. Brooks, C. C. Wheelen, C. H. Neely and R. W. Neely, all of Washington.

THE UNIQUE ELECTRIC DEVICE COMPANY, of New York City, has been formed to manufacture electrical machinery, etc. Capital, $10,000. Incorporators: J. P. Hynes, M. Soreham, M. Hynes, all of New York City; J. J. Hynes, attorney, New York City.

THE ARCHIBALD-BRADY COMPANY, of Syracuse, has been formed to construct street surface railroads, electric lighting plants, telephone, telegraph and gas plants. Capital, $50,000. Directors: William K. Archibald, New York City; Paul T. Brady and Robert E. Drake, Syracuse.

LEGAL.

BIDWELL IN MILWAUKEE.—Benson Bidwell et al. have brought suit against the Milwaukee Electric Railway & Light Company to restrain it from further alleged infringement of complainants' patent rights. The plaintiffs allege that they are owners of the patent whereby electric cars are lighted by the same current that is used to run them. They ask for an accounting and demand that the income unlawfully derived from the violation of the plaintiffs' rights be stated and damages paid accordingly. Last June Mr. Bidwell brought suit against the Indianapolis Street Railway Company for damages for alleged infringement of certain of his patents.

PHONOGRAPH RIGHTS.—A special despatch from Cincinnati, of Sept. 25, says: "The National Phonograph Association met at the Burnet House, 100 members representing 32 phonograph companies of the United States being present, and took steps toward bringing suits to enjoin Thomas A. Edison from further alleged breaches of contract in selling to others territorial rights which they assert he sold to them in 1888, and which contracts do not expire, they claim, until 1903. Suits for damages against Mr. Edison and for an accounting of the machines and territory so disposed of were also arranged for. The following officers were elected: President, A. W. Clancey, Chicago; vice-president, R. C. Kinead, Louisville; secretary, J. L. Andem, Cincinnati; treasurer, E. D. Easton, Washington.

OBITUARY.

S. V. ESSICK.—Mr. Samuel V. Essick died on Friday, Sept. 28, at his home in Yonkers, N. Y., after a short illness. He was in his sixtieth year. Mr. Essick was born in New Franklin, Ohio. He was a lawyer, but he was better known on account of his inventions, among the more important of which is a printing telegraph. When the machine was first brought out it was tried in New York newspaper offices. He went to Yonkers to live in 1891. Before that he lived in Brooklyn, where he was associated in business with Abner McKinley. He is survived by his wife, one son and a daughter.

PERSONAL.

MR. HORATIO A. FOSTER, the consulting electrical engineer, has removed from Buffalo to Philadelphia.

MR. W. MAVER, JR., has an interesting article in the current *Cassiers Magazine* on the manufacture of electrical cable.

MR. F. E. HATCH, president of the Hatch Electric Smelting Company, of Green Bay, Wis., was a visitor in Chicago last week.

MR. HUGH HARRISON, who has been prominently identified with many electrical enterprises in this country, has been in London lately.

MR. E. H. JOHNSON is expected in this country the present week from London, accompanied by Mr. Leonard W. Holmes, who is well known in English electrical circles.

MR. J. LEVERING JONES, of Philadelphia, and Mr. J. B. Stauffer, of New York, have been added to the board of directors of the Erie Telegraph & Telephone Company.

MR. F. A. BARBEY has been appointed New England representative of the Standard Pneumatic Tool Company, of Chicago, and has opened an office at 185 Summer Street, Boston, Mass.

MR. E. M. JACKSON, superintendent of construction and maintenance for the Central Union Telephone Company, Chicago, has started on a trip to San Francisco and Honolulu in search of health.

MR. RALPH D. MARCHAND, for some years an engineer for the Westinghouse Company in connection with the long-distance transmission of electricity, has been appointed to a similar position with the Montreal Street Railway and the Chambly Manufacturing Company, of Montreal.

MESSRS. THAYER AND KINGSBURY, of the Western Electric Company, have sailed for England this week on the Oceanic. On board the same steamer are Messrs. Sinclair and Gaine, of the National Telephone Company, of England, who have been making a trip through this country as far as San Francisco. They had time for but a brief stay in New York.

MR. ARTHUR WARREN, of the Westinghouse Electric & Manufacturing Company, is again in New York after a prolonged stay in London and Paris. Besides organizing much of the Westinghouse exhibit work at the Paris Exposition, Mr. Warren made a "palpable hit" with a Westinghouse generating plant and car in full operation on a long stretch of conduit track at the London tramway exhibition in June.

MR. A. K. WARREN, who has been well known for many years in New York City as an electrical engineer and expert on dynamo machinery, has severed his connection with the American Electrical Maintenance Company, of which he was vice-president and general manager. He is now returning to the old field occupied by the A. K. Warren Company and is ready to estimate on construction or repair work, or to act as consulting engineer in regard to the installation of electric light or power. Those who, as manufacturers or users, secure his services will have unusual experience and ability at their command.

MR. HENRY G. ISSERTEL, E.E., has made an important connection in his old familiar field of dynamo machinery, and will hereafter represent the apparatus of the Sprague Electric Company, paying special attention to the "split-pole" type. Mr. Issertel is an old T.-H. man, and was a pioneer in railway work, etc. His success as selling agent for the late Walker Company is well remembered in the trade, and there seems no good reason why it should not be repeated under the favorable conditions of his new alliance. Mr. Issertel will for the present have his office at the company's New York headquarters, in West Thirty-fourth Street.

EDUCATIONAL.

UNIVERSITY SCHOOL.—The eighth annual announcement of the University School, Clanton, Ala., for 1900-1901, is just issued. It gives a list of the courses of study, expenses, etc.

COURSE IN ELECTRO-CHEMISTRY.—The Massachusetts Institute of Technology announces that it has organized a special course in electro-chemistry. The new option for second-year students will go into effect at the beginning of the school year 1900-1 and for the third and fourth years in 1901 and 1902, respectively.

Trade Notes.

PARIS AWARD.—The Eldredge Electric Manufacturing Company, Springfield, Mass., was awarded a diploma at the Paris Exposition on its exhibit of pocket instruments.

THE FARR TELEPHONE & CONSTRUCTION SUPPLY COMPANY, Chicago, has been awarded a bronze medal on its display of telephones and telephone appliances at the Paris Exposition.

IDEAL ENGINES FOR RAILWAY WORK.—A. L. Ide & Sons, Springfield, Ill., has issued a pamphlet describing and illustrating its four-ported engine for railway and other heavy service.

THE ARNOLD ELECTRIC POWER STATION COMPANY, Chicago, is sending out to the trade a folder, in which is described the character of its business, and refers to various plants of its design. This company takes contracts for the building of electric plants.

THE SENECA FALLS MANUFACTURING COMPANY, Seneca Falls, N. Y., has issued a new catalogue of its foot and power lathes, with its usual specialties, such as the "Star" screw-cutting engine lathe, and the usual accessories, such as the tapping attachment and ball-bearing arbor press.

THE NATIONAL CABLE & WIRE COMPANY, Pittsburg, Pa., which was organized some time ago, with a capitalization of $1,000,000, has purchased the mower and reaper works at Latrobe, Pa., for the purpose of remodeling this factory and changing it into a works for the manufacture of electrical supplies.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is jubilant over the fact that three of its agencies have carried off prizes at the Paris Exposition—"Beyond competition," and "For high standard of excellence." The winners are the A. B. arc lamp, Packard incandescent lamp and the Packard transformer.

FOREE BAIN, Monadnock Block, Chicago, consulting engineer and solicitor of patents, will be glad to send his little vest pocketbook, "Useful Information for Practical People," including many engineering tables and other convenient figures, on receipt of 4 cents postage, or 29 cents for the book enclosed in a morocco leather cover and card case.

THE DEDION-BOUTON MOTORETTES and quadricycle won all the events of their classes at the Tri-State Fair in Guttenburg, N. J., recently, against all comers. They also came in first and second in the Automobile Club run on Saturday, Sept. 22, from the Waldorf Hotel to the Larchmont Yacht Club against steam machines and various types of gasoline machines, over fifteen vehicles being in the run.

BELKNAP MOTOR COMPANY, Portland, Me., took a prize recently at the Paris Exposition, as noted in these pages, on its Chapman or Belknap automatic voltage regulator. It went to the show not merely with the idea of securing an award, but because it has already had many inquiries from abroad. Its export trade is, in fact, growing to considerable proportions, and now requires careful watching and separate attention.

RHEOSTATS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., recently issued a set of bulletin sheets pointing out the features and giving dimensions and other information regarding various types of the rheostats manufactured by that company. Many of the sheets are illustrated with views of the apparatus and diagrams showing how the rheostats are connected up in relation to different electric systems.

CHARLES H. BESLY & COMPANY, Chicago, report that they have made a number of large shipments to the North and Middle West of complete shop equipments, and are receiving many orders for small tools from the same sections. Many orders for Helmet oil, Bonanza cups and Helmet babbitt are daily being received from the Western mining districts. Their new catalogue is now ready for distribution and will be mailed free to any address upon application.

TOWER ILLUMINATION.—The new tower being finished by Montgomery Ward & Company, as the highest in Chicago, is to be surmounted by a statue of Diana, which is to be electrically illuminated so as to make the statue visible at night. At each of the four corners of the tower below the statue a large Multiplex Reflector Company's reflector will be placed, and the rays of light are to be directed upward at the statue. The statue will be gilded, and it is expected that a fine effect will be produced. The contract for the electrical illumination material is being carried out by the W. R. Garton Company.

THE NEW YORK AUTOMOBILE SHOW.—Mr. Marcus Nathan, manager of the Automobile show, which is to be held at the Grand Central Palace, New York, Nov. 14 to 24 next, is sending out to the trade and those concerned some printed matter of general and special interest. This show promises to be the best of its kind ever held in New York, and the fact that there is an extraordinary demand for exhibition space is proof that it will be a display worth coming many miles to see. Automobilism is on the jump, and the big jumps it is taking will be exemplified at the Grand Central Palace on this occasion in a way that will be convincing and interesting.

TRIUMPH ELECTRIC COMPANY, of Cincinnati, Ohio, writes us: "It will probably be interesting for you to note that our company has just been awarded a medal at the Paris Exposition for its machines. This award came as an entire surprise, for the company was not a direct exhibitor at the Exposition, and, of course, did not expect to receive a medal. Its machines on exhibit there were loaned the Fay & Egan Company, the Ferracute Company and also the R. K. LeBlonde Company for operating their exhibits. As the company was not a direct exhibitor it was not competing for a medal, and consequently did not expect one. Evidently its machines must have attracted quite a little attention; or otherwise the commmittee of awards would hardly have given the company a medal, so that it feels greatly complimented."

INSULATING VARNISHES AND COMPOUNDS.—The Eagle Paint & Varnish Works, Pittsburg, Pa., have just issued a retail price list of their Eagle insulating varnishes, paints, compounds and specialties. Eagle insulating varnish is especially adapted for use on all bare metal surfaces, either dipped or varnished, machine-wound armatures, armature core plates, field coils, switch bases, brush holders, mouldings, cloth, wood, tape, paper, etc. Of the new specialties of this company Eagle winding-lac is an air-drying insulator, very adhesive, holds the wires in place, dries quickly, but never becomes brittle, is not affected by acids or alkalies, resists the oxidation of copper and does not carbonize. Eagle lac-black, another specialty, is particularly suited for finishing armatures, field coils, etc. It dries hard in 10 to 15 minutes with a high gloss. It is unaffected by water, lubricating oils, acids or alkalies, and can be used for general insulating purposes.

P. & B. INSULATION.—Among the most important features of the modern ocean passenger steamship are the refrigerating and cold-storage rooms. Each vessel carries its own ice-making machinery, and in the construction of the rooms containing the plant, besides the cold-storage rooms, an even temperature must be maintained at all times. In order to secure this condition air-tight and moisture-proof insulation materials are necessary. P. & B. giant insulating papers, made by the Standard Paint Company, New York, have been used in this

class of work on many of the most famous ocean steamers, including the Deutschland, the St. Paul, St. Louis, Kaiser Wilhelm der Grosse and many others, and on the principal steamers of the Cunard Line, White Star Line and other equally well-known lines. It is stated that the experience had with P. & B. insulation on the vessels mentioned proves that the temperature in their cold-storage rooms is very easy to regulate, because the insulation is perfect.

AN IMPROVEMENT IN CATALOGUES.—The Electric Gas Lighting Company, 195 Devonshire Street, Boston, Mass., has just issued the 18th edition of its illustrated catalogue and price list of electrical house goods and general electrical supplies. It is called a "four-department catalogue," which means that its contents are classified by departments, viz.: Electric gas lighting, Electric batteries, Electric house goods and Electric light supplies. A side index enables one to turn at once to the pages devoted to any one of these departments. This is a commendable feature, as it saves the time usually spent in hunting through catalogue pages for the articles of any particular class. Besides the side index there is a complete general index. The catalogue contains 236 pages, with illustrations of the articles listed, of which there is a very large number. This company is now carrying a full line of electric light supplies, which department alone takes up 74 pages of the catalogue.

THE WATSON-STILLMAN COMPANY, 204 East Forty-third Street, New York, has issued a new catalogue, compiled from its illustrated sheets of its die presses, hydraulic pumps, packings, etc., which will prove interesting to any electrical manufacturer who has use for hydraulic presses in his establishment. Among the tools manufactured by this company, which are of special interest to electrical manufacturers, might be mentioned one for compressing small pieces of mica into large sheets, thus enabling the waste mica to be made up again and re-used. This is a machine of great economical value in such plants. It also makes a small hand-power hydraulic riveter which is especially designed for riveting connections in the commutators of large dynamos; street railway rail bonds are also headed by this same machine. Another interesting machine for street railway purposes is its hydraulic car axle straightening press, while its hydraulic jacks are, of course, available for all purposes where lifting, pushing or pulling is concerned.

PLATINUM.—In his interesting paper, read before the convention of Municipal Electricians at Pittsburg last week, Mr. F. C. Mason says: "The production of platinum alloys specially adapted for contacts under all conditions of current density and temperature has been very carefully investigated by Baker & Company, the platinum refiners of Newark, N. J., who now regularly manufacture a number of alloys possessing all the requisite properties for durable and perfect contacts. Their XXV. brand is especially designed for use in electric signaling apparatus, and is now generally specified in awarding contracts for high-grade instruments. For commercial reasons the composition of this and their other alloys is kept secret; but as to the operative value of contacts made from these alloys I can say from personal observation that too much credit cannot be awarded this firm for its conscientious efforts to produce an article so vitally important to the certain operation of signaling apparatus, and which fully meets our exacting requirements."

Record of Electrical Patents.

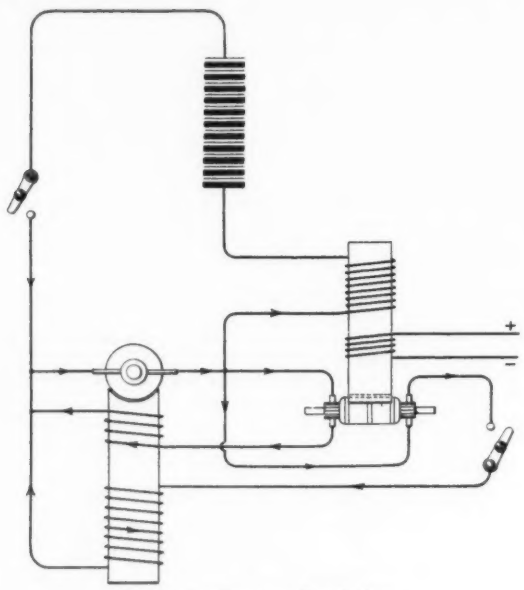
UNITED STATES PATENTS, ISSUED SEPT. 25, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

658,336. ELECTRIC RAILWAY; E. M. Bentley, New York, N. Y. App. filed Aug. 5, 1896. An exposed sectional working conductor normally disconnected from the circuit extends along the track like a third rail, there being a contact device carried by the car, adapted to pass over the sections in succession. The sections are connected with the feeding conductor by a manually controlled circuit closer operated by a signal man from a distant point.

658,388. MECHANISM FOR IMPARTING SUCCESSIVE OR ALTERNATING MOVEMENTS; E. Moore, Meductic, Canada. App. filed Nov. 15, 1899. Relates to means whereby an electric current is alternately shifted in order to operate the switch tongue of a tramway switch.

658,412. METHOD OF TREATING ORES; G. M. Westman, New York, N. Y. App. filed Jan. 12, 1899. Relates to a method of treating arsenical ores. The freeing of the arsenic from the ore is accomplished in a closed chamber from which the poisonous arsenic vapors are led to a suitable condenser. At the same time the precious metal which may be present may be collected and saved. The heating and melting are accomplished by means of electric currents.



658,476.—Dynamo Regulation.

658,423. CARBON ROD FOR ELECTRIC ARC LAMP; H. Bremer, Neheim, Germany. App. filed Aug. 5, 1899. A carbon electrode for arc lamps containing a salt of an alkaline earth uniformly mixed with the carbon and provided with an air-tight, glassy coating adapted to burn at the extremity of the electrode and then to absorb and chemically combine with the basic slag produced by the burning of the electrode.

658,431. DYNAMO BRUSH; C. Endruweit, Berlin, Germany. App. filed Aug. 7, 1899. A dynamo brush, consisting of homogeneously united metallic foils and carbon strips, so compiled that metal and carbon appears in alternate layers.

658,445. ELECTRIC CAR; A. A. Ingraham, Lowell, Mass. App. filed Oct. 2, 1899. Relates to details of gearing and motor support.

658,476. DYNAMO REGULATION; I. E. Storey, Trenton, N. J. App. filed Feb. 23, 1900. Provides means whereby generators driven by the axle of a railway car and therefore subjected to wide variations of speed may be made to maintain a substantially constant voltage.

658,483. PROCESS OF OXIDIZING NEGATIVE ELECTRODES FOR PRIMARY BATTERIES; C. J. Coleman, Chicago, Ill. App. filed Dec. 20, 1899. The process comprises the oxidation of a body of finely divided or porous copper into a coherent mass by placing it in an oxidizing atmosphere and simultaneously supplying to it a requisite amount of moisture.

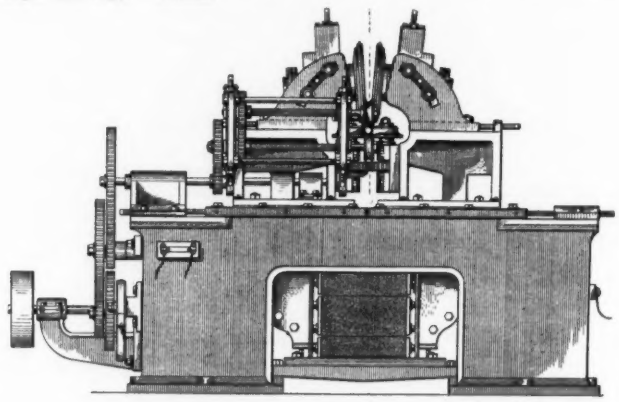
658,541. BOND-TIE FOR ELECTRIC RAILWAYS; W. A. Downing and J. T. McHugh, Pittsburg, Pa. App. filed Feb. 21, 1900. In order to prevent tampering with the rail bond it is placed within the fish-plate.

658,581. TROLLEY; A. Piton, St. Sauveur de Quebec, Canada. App. filed April 17, 1900. The roof of the car is provided with a spring-repressed tension arm to which the cable from the trolley pole may be detachably connected, the spring of the arm opposing the spring of the trolley pole.

658,601. APPLIANCE FOR IMPARTING HEAT AND ELECTRICITY TO THE BODY; I. Timar, Berlin, Germany. App. filed Nov. 10, 1899. Comprises a metallic electrifying frame and a rubber bag adapted to hold certain calorific substances applicable to heating the body when brought in contact therewith.

658,698. ELECTRIC FURNACE; C. S. Bradley, New York, N. Y. App. filed Feb. 10, 1900. Comprises a furnace of the moving-receptacle type and means for supplying gas to the receptacle at a definite part of its movement, so as to effect a particular reaction.

658,706. ELECTRIC STOVE; H. J. Dowsing, London, England. App. filed Sept. 12, 1899. Details.



658,741.—Electric Welding Machine.

658,733. SECONDARY BATTERY; C. J. Coleman, Chicago, Ill. App. filed Dec. 8, 1899. The active material is contained within perforated cylindrical casings arranged side by side in close relation in the battery cell. The positive and negative electrodes of adjoining cells are integrally connected together.

658,734. SECONDARY BATTERY; C. J. Coleman, Chicago, Ill. App. filed Oct. 2, 1899. A perforated casing encloses a longitudinal cell which contains the active material. The casing is formed of a double series of half-cylinders, the two series being bolted together.

658,741. ELECTRIC WELDING MACHINE; O. Parpart, Cleveland, Ohio. App. filed Jan. 31, 1898. Provides for the electric welding of the butt joints of tubes. Two electric current-conducting devices are respectively connected with opposite electric poles and are adapted to pass directly on the opposite edge portions of the butt-joint of a tube. Two rolls tend to feed the tubes along and force the ends together.

658,745. TROLLEY WHEEL; D. F. L. Jones, Columbus, Ohio. App. filed Aug. 12, 1899. Details.

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POSITION WANTED—As superintendent or manager of electric light plant; have had 12 years' practical experience in light and power station work, last six years as superintendent; thoroughly versed in electrical and mechanical engineering; desires change; best of reference. Address "EXCELSIOR," care Electrical World and Engineer, New York.

POSITION WANTED—As superintendent of electric lighting plant west of Chicago by a man with 12 years' practical experience in the installation and operation of electric lighting plants; familiar with every branch of electrical construction, alternating and direct-current generators, motors and arc lamps; understand monocyclic system of lighting and power. Address "POWER," care Electrical World and Engineer, 936 Monadnock Block, Chicago, Ill.

POSITION WANTED—By a graduate of electrical school, Columbia College, with some electrical concern; age 28; best of references given. Address "E. E.," care Electrical World and Engineer, New York.

POSITION WANTED—As superintendent or superintendent and manager electric light plant or repair shop by electrical engineer; 10 years' experience in erection, maintenance, and repairs electrical and steam machinery; wide experience construction work, and purchasing all classes construction material; references. Address "M. J. S.," care Electrical World and Engineer, New York.

POSITION WANTED—To take charge of high-speed engine in electric light plant; country town preferred; unquestionable reference; will go anywhere. Address "N. W. H.," care Electrical World and Engineer, New York.

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K. McLENNAN & CO., SOLE MANUFACTURERS, 909, 100 Washington Street, CHICAGO.

IF YOU WANT AN ARTICLE THAT WILL GIVE SATISFACTION TRY

U.S. METAL POLISH Geo. W. Hoffman,

FOR POLISHING ALL KINDS OF METALS. Indianapolis, Ind.

POSITION WANTED—By technical engineer, experienced in designing and constructing pole lines, distributing systems, common battery telephone offices of every size, and electric light plants, with a consulting and contracting engineer. Address "T. P.," care Electrical World and Engineer, New York.

POSITION WANTED—By electrician; six years' experience in testing department of leading dynamo and motor manufacturer, in charge last two years; thoroughly acquainted with all forms of direct and alternating-current machinery; desires position in factory, construction or railroad work; best of references. Address "W. B.," care Electrical World and Engineer, New York.

POSITION WANTED—Armature winder, all-round, direct-current electrician and mechanic, desires work with construction, manufacturing or repair company; thorough, practical man, accustomed to trouble hunting and expert repairing; good draughtsman, pattern maker and machinist; familiar with automobile and railway work, car wiring, etc.; sober, steady hustler; handle men and business; go anywhere; reasonable. Address "GERMAN-AMERICAN," care Electrical World and Engineer, New York.

HELP WANTED.

The rate for "Help Wanted" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each. Remittance should accompany order.

WANTED—By an engineering school of high standing in the Middle States an assistant in the Electrical Laboratory. He must be a technical graduate, thoroughly capable of installing electrical machines, testing them, etc. A man who has had two or more years' experience in the testing laboratory of one of the great electric manufacturing companies preferred. Address, giving complete experience and references, "X. Y. M.," care Electrical World and Engineer, New York.

WANTED—A young man with a technical education to do cable testing and trouble hunting for a large telephone company in Pennsylvania; permanent position and lots of room for advancement. Please state salary expected. Address "N. Z. D.," care Electrical World and Engineer, New York.

WANTED—Assemblers of direct and alternating ceiling and desk fans; also men to inspect and test these motors. Address "FANNIE," stating experience, wages required and giving references, care Electrical World and Engineer, New York.

WANTED—Thoroughly competent man to take charge of small drawing plant; must be well posted and a hustler, reliable and sober. Address, with references, "WIRE," care Electrical World and Engineer, New York.

WANTED—By an old-established house a salesman thoroughly familiar with electrical construction and competent to estimate on electric light, installation, etc., from architects' plans and specifications. Address, stating age, experience and salary expected, "F. W. M.," care Electrical World and Engineer, New York.

WANTED—An expert carbon mounter on fine miniature incandescent electric lamp work. Please state experience and where formerly employed; also other experienced hands in this line. Address JAEGER MINIATURE LAMP MFG. CO., Bible House, 8th St., and 4th Ave., New York.

WANTED—By a well-established company an electrical engineer to design and superintend the manufacture of electrical machinery; must be well versed in the theory and practice of direct and alternating currents and willing to invest not less than $5,000. Address "C. T.," care Electrical World and Engineer, New York.

The first and most important point about advertising is to select the right medium. If you want to do business with any man in the electrical field in any part of the world, the right medium to advertise in is Electrical World and Engineer.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO.

110-VOLT INCANDESCENT DYNAMOS.

1	12-light		Hartley, self-oiler, M.P.
2	12	"	Edison, ¼ K.W.
1	26	"	Perett.
1	50	"	Hawkeye.
1	50	"	Card, self-oiler.
1	50	"	Nowotny, self-oiler.
1	50	"	C & C, self-oiler.
1	50	"	Mather.
1	60	"	T.-H., 75 volts, comp., with extra armature.
1	75	"	Thomson-Houston, D5.
1	75	"	Wood, self-oiler.
1	90	"	Westinghouse.
1	100	"	Cutten.
1	100	"	Jenney, comp.
1	200	"	Western Electric, self-oiler.
1	225	"	United States.
1	250	"	Westinghouse, horiz. type.
1	250	"	Commercial, comp., self-oiler.
1	270	"	T.-H., comp., self-oiler, D15.
3	270	"	Westinghouse, M.P., s. s., 15 K.W., October delivery.
1	300	"	Columbian, M.P., s. o.
1	340	"	Eddy, self-oiler, compound.
2	350	"	Hawkeye, comp. wound.
1	350	"	National, self-oiler, compound.
3	350	"	Edison, 20 K.W., self-oilers.
1	350	"	Fisher, M.P.
1	360	"	Duplex, M.P., self-oiler, compound, slow speed.
1	450	"	Edison, 25 K.W., self-oiler.
1	540	"	Edison, 30 K.W.
4	540	"	Edison, 30 K.W., s. o.
4	540	"	Edison, 30 K.W., self-oilers, compound.
1	600	"	Eickmeyer.
1	700	"	Siemens & Halske, 40 K.W., multipolar, slow speed.
2	700	"	Westinghouse, 10-pole, slow speed, 40 K.W., s. o., new.
4	800	"	Edison, 45 K. W., self-oilers.
1	1350	"	Waddell-Enz, 80 K.W., M.P., for direct connection.

220-VOLT GENERATORS.

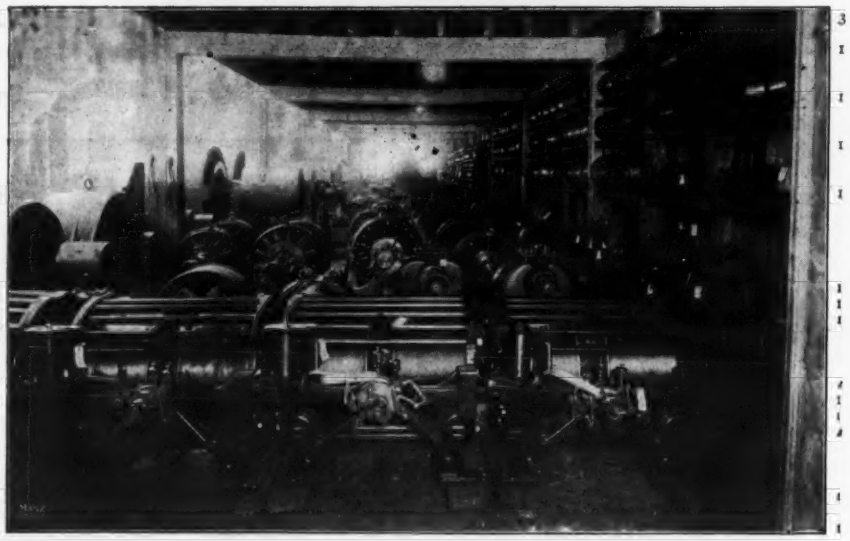
1	7½	K.W.	Gen. Elec., M.P., self-oiler.
1	9	"	Lundell, self-oiler.
1	10	"	Lundell, s. o., M.P., slow sp.
1	12	"	Eddy, s. o., new arm't.
1	15	"	Edison, compound, self-oiler.
1	25	"	Edison, self-oiler.
1	30	"	Crescent, M.P., self-oiler.
1	50	"	Westinghouse, comp, s. o.

500-VOLT GENERATORS.

2	15	K.W.	Edison, self-oilers.
1	15	"	T.-H., self-oiler.
1	25	"	T.-H., s. o., D25, compound.

GREGORY ELECTRIC CO.

54-62 S. CLINTON ST. CHICAGO.



VIEW DYNAMO AND MOTOR DEPT., GREGORY ELECTRIC CO.

1	25	K.W.	Edison, self-oiler.
1	35	"	Mather, self-oiler.
3	45	"	Edison, compound, self-oilers.
1	75	"	Westinghouse, Kodak set, direct-connected.
1	75	"	Westinghouse, M.P.
1	150	"	Detroit (Rae), M.P., compound, s. o., new armature.

ALTERNATING GENERATORS.

1	350-light		T.-H., A18, 15,000 alt., 1100 v., comp. wound, with exciter.
1	600-light		Bain, 30 K.W., s. o., 1100 or 2200 v., new toothed arm't, 15,000 alt., with exciter.
2	600	"	T.-H., A6, 30 K.W., 15,000 alt., 1100 volts, s. o., with exciter.
1	600	"	T.-H., 30 K.W., 2-phase, 1100 volts.
1	600	"	Gen. Elec., A30, slotted arm't, compound, s. o., 1100 volts.
2	650	"	T.-H., A35, s. o., 15,000 alt., 1100 v., composite wound.
2	750-light		Westinghouse, 16,000 alt., s. o., 37½ K.W.
1	1000	"	Wood, 50 K.W., s. o., 16,800 alt., 1100 v., toothed arm't, comp. wound.
1	1200	"	Westinghouse, 60 K.W., s. o., toothed arm't, 1100 volts.
2	1200	"	G. E., A60, 1100 or 2200 volts, 15,000 alt., comp. wound, toothed arm't, self-oiler.
3	1300	"	T.-H., A70, 1100 v., 15,000 alt., s. o., compound wound.
1	1500	"	Wood, 75 K.W., 1100 volts, 16,800 alt., self-oiler, comp. wound, slotted armature.
1	2000	"	T.-H., 100 K.W., 1100 volts, 15,000 alt., self-oiler, toothed armature.
1	2000	"	Wood, 100 K.W., 1100 v., 16,800 alt., s. o., toothed arm't, comp. wound.
1	4000	"	Wood, 200 K.W., 1100 v., 16,800 alt., s. o., slotted arm't, comp. wound.

ARC DYNAMOS.

1	20-light	2000	C.P.	Western Electric.
1	30	2000	"	West. Electric, s. o.
1	30	2000	"	Brush, No. 7, with latest improved Steubenrausch commutator.
4	35	2000	"	T.-H., LD2.
1	40	2000	"	West. Electric, s. o.
1	45	1200	"	T.-H., M12, ball arm.
4	45	1200	"	Brush, No. 7, with latest improved Steubenrausch commutator.
1	50	1200	"	T.-H., LD12, ball armature.
1	50	2000	"	T.-H., MD2, s. o., ring armature.
1	50	2000	"	Brush, No. 7½.
2	60	2000	"	West. Electric, s. o.
1	60	2000	"	Westinghouse, toothed arm't, 6-pole, direct current, s. o., complete with exciter.
2	60	2000	"	Wood, No. 8.
1	65	2000	"	Brush, No. 8, new arm't, extra fine, with latest improved Steubenrausch fireproof commutators.